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BIOMEDICAL TECHNOLOGY PROSPERITY GAME™

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Final Report by

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ABSTRACT

Prosperity Games™ are an outgrowth and adaptation of move/countermove and seminar War Games. Prosperity Games™ are simulations that explore complex issues in a variety of areas including economics, politics, sociology, environment, education and research. These issues can be examined from a variety of perspectives ranging from a global, macroeconomic and geopolitical viewpoint down to the details of customer/supplier/market interactions in specific industries. All Prosperity Games™ are unique in that both the game format and the player contributions vary from game to game.

This report documents the Biomedical Technology Prosperity Game™ conducted under the sponsorship of Sandia National Laboratories, the Defense Advanced Research Projects Agency, and the Koop Foundation, Inc. Players were drawn from all stakeholders involved in biomedical technologies including patients, hospitals, doctors, insurance companies, legislators, suppliers/manufacturers, regulators, funding organizations, universities/laboratories, and the legal profession.

The primary objectives of this game were to:

- Identify advanced/critical technology issues that affect the cost and quality of health care.
- Explore the development, patenting, manufacturing and licensing of needed technologies that would decrease costs while maintaining or improving quality.
- Identify policy and regulatory changes that would reduce costs and improve quality and timeliness of health care delivery.
- Identify and apply existing resources and facilities to develop and implement improved technologies and policies.
- Begin to develop Biomedical Technology Roadmaps for industry and government cooperation.

The deliberations and recommendations of these players provided valuable insights as to the views of this diverse group of decision makers concerning biomedical issues. Significant progress was made in the roadmapping of key areas in the biomedical technology field.

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EXECUTIVE SUMMARY

In most applications, the introduction of new technologies tends to reduce costs and increase productivity and the quality of goods and services. However, in the medical field, new technologies have often tended to increase costs, although generally increasing quality. This Prosperity Game™ focused on critical technology and policy issues that could lower the cost of health care while maintaining or improving quality. Hence, major effort was devoted to estimating costs and returns on investment. This was also the first game to combine the simulation with the development of technology and policy roadmaps for future industry and government cooperation on research and development.

The game explored biomedical technology from three points of view. The **consumers** represented patients and their problems, including specific diseases and disabilities, costs for services, and treatments options. The **providers** represented doctors, hospitals, research organizations, manufacturers and their problems including R&D, delivery systems, regulations, etc. The **national interest** in health care was represented by private and public stakeholders including legislators, insurers, government customers and payers, the US FDA, etc.

An important objective of this effort was to prepare the groundwork for subsequent development of biomedical technology roadmaps. Although the contributions of this event to roadmapping are discussed in detail in the text and appendices, the major documentation will be released by the sponsors in a future report. This report focuses primarily on the issues raised by the multitude of stakeholders, the models employed in estimating costs and quality, and the priorities supplied by the players for their technology and policy investments.

The game was designed to optimize investments in technologies through the use of limited resources, political pressures, and the physical consequences of inadequate technology (i.e., disability, loss of productivity, death, loss of jobs or profits, etc.). The Toolkit of investment options was designed to strongly encourage partnerships and teamwork. As in real life, some teams cooperated well among themselves and with other teams, and some were plagued even with internal dissension.

The game employed 32 disease/disability (D/D) cards that spanned most of the important health care concerns, including 8 cards focused on diagnostics and prevention. Each card had four outcomes (with associated probabilities) that were assigned to current treatment practices and new treatments based on advanced technologies. These cards, together with assumptions concerning demographics and D/D frequencies, were used to estimate the returns on investment for new technologies. Not surprisingly, such returns in general greatly exceeded the R&D investments, especially considering the restoration of the patient to the work force, or the reduction in maintenance costs for long-term care. Hence, the introduction of new technologies **<u>can</u>** substantially reduce medical costs while maintaining or increasing quality. The payback times and ratios vary, depending on the expected improvement in treatment outcomes, and the frequencies of D/D occurrence. For example, using true demographics, the 10-year return on investment net benefits (relative to costs of current treatments) for one year's patients using new breast cancer screening technology was $14.4 billion; for new diabetes technology, the net benefit was $29.3 billion. We believe that the simple methodology introduced here

can be refined and expanded with additional clinical, fiscal, and R&D data to prioritize investments in health care technologies that will result in significantly better returns.

The game also attempted to subjectively measure quality, as determined by the opinions of the patients and doctors. In this simulation, the doctors in general were more satisfied with the outcomes than were the patients. In almost all categories surveyed, the doctors evaluations were higher and more positive than the patients. Not surprisingly, improved technologies generally correlated with improved outcomes, and resulting higher satisfaction among both patients and providers.

The priorities of the stakeholders were assessed in the game based on investments in Toolkit technologies (59 options) and policies (10 options), in their own technology and policy initiatives, and in a separate session devoted to defining key issues, problems, and important associated technologies. Based on all three of these priority metrics, the players ranked preventive medicine as the most promising area for research, followed in order by Health Informatics, Telemedicine, Information Surety and Security, Assistive Technologies, Outcomes Research Tools, Microelectronics and Sensors, and Minimally Invasive Therapies.

Internal Organ-Related technologies drew investments in excess of $1.5 billion, the largest of any category based on dollars invested. The second largest dollar investment was in Outcomes Research tools at $1.32 billion.

The players expressed a strong desire to obtain information and make it readily available to both patients and doctors; there were ten such investments for a total of $1.56 billion.

Based on player evaluations, this was the most successful game conducted to date. Nevertheless, the teams varied in their ability to cope with the game challenges. Some teams were very successful. Others had some particular agendas that led them to fight the game, rather than work within it.

The Consumers demonstrated a strong desire for self- and home-care. They learned the importance of money and policy in the game, which they believed "swamped" the technology issues.

The Independent Providers did not remain independent for long. They formed a multi-specialty group to better compete with HMOs. They felt this behavior was in fact the real direction that independents had to pursue. They shared the objectives of delivering high-quality care at low cost with the HMO team. However, the HMO team signed a contract with the Insurers that proved disastrous for them. They believed that developing new technologies was sometimes not as important as using existing technology better.

The Insurers team struggled from the outset. Some of their decisions led to subsequent law suits and antitrust claims. Although lawyers were available in the game, they were generally not used until after a team had negotiated a poor contract.

The Legislators were very proactive, and drafted some important bills to assist the development and introduction of new technologies, and to improve and streamline the regulatory processes.

The Suppliers/manufacturers gathered market data and used this intelligence to determine their technology investments. They developed several product lines in: home healthcare, cell-cultured replacement organs, an RF cancer

treatment, biogenetic markers, and an alliance for standards and data transfer.

The FDA team felt they made significant progress in improving the regulatory process. They also felt that they played an important educational role in the game.

The Planning/Funding team was hampered by internal disagreements about the relative importance of telemedicine. They were not able to compromise. They also believed there was too much money in the game.

The Universities/Labs team created a Strategic Health Care Office for coordinating a national program on biomedical research and development.

The Lawyers initially struggled with their role. However, poorly structured contracts and illegal actions soon brought them into the mainstream. They suggested that every team have a lawyer to help negotiate the contracts before problems arose.

This was a very ambitious game-roadmapping event, combining in two days what would normally take four. Hence, it is not surprising that many players felt they needed much more time, especially for the simulation part. Some of the important suggestions for improvement were:

- Don't change teams or facilitators during the event
- Need two insurance teams, two supplier teams
- More emphasis on policy
- Choose players who can transcend their subspecialties
- Need more real-time feedback
- Computerize entire process.

Overall, this was the most successful Prosperity Game™ yet conducted. Many of the players' comments indicated their satisfaction:

"The role playing game was a well designed model for the generation of a technology forecast. It identified needs for technology development based on outcomes."

"Challenging, stimulating. Quickly brought into focus driving forces directing health care systems and application of technologies to meet mission, goals, and objectives.

"Great collaboration with Universities/Labs R&D."

"Despite the time limitations, the game was often very realistic in behaviors and reactions."

"A wonderful, stimulating, occasionally frustrating experience."

"A great experience. I learned a lot."

"I found the format and the intellectual content quite stimulating. What a strong, effective concept."

"Outstanding simulation of the health system complexity."

"Greatest workshop I ever attended."

INTRODUCTION

A Prosperity Game™ is a new type of forum for simulating and exploring complex issues in a variety of areas including economics, politics, sociology, environment, education, research, health care, etc. The issues can be examined from a variety of perspectives ranging from a global, macroeconomic and geopolitical viewpoint down to the details of customer/supplier/market interactions in specific industries. The concept originated in meetings with the staff of New Mexico Senator Jeff Bingaman, with Lee Buchanan of the Advanced Research Projects Agency, and with other government and industry people, and was developed by J. Pace VanDevender and Marshall Berman for a wide variety of applications.

Prosperity Games™ simulate and explore complex issues

Prosperity Games™ are an outgrowth of move/countermove and seminar war games. They are executive-level interactive simulations that encourage creative problem solving and decision-making, and explore the possible consequences of those decisions in a variety of economic, political and social arenas. The simulations are high-level exercises of discretion, judgment, planning and negotiating skills, not computer games. They explore the challenges and opportunities faced by businesses, government, laboratories, universities and the public.

Eleven previous Prosperity Games™ have explored environmental issues, economic competitiveness in electronics manufacturing and information technology, university business education, the business case for diversity, and the relationships of the Department of Energy National Laboratories. This is the first major game that focuses on biomedical technologies.

GAME THEORY

In mathematics, game theory is the study of strategic aspects of situations of conflict and cooperation. "Game Theory approaches conflicts by asking a question as old as games themselves: How do people make 'optimal' choices when these are contingent on what other people do?"[1] Game theory originated with the mathematician John von Neumann as early as 1928. The collaboration of von Neumann on theory and Oskar Morgenstern on applications to economic questions led to the seminal book *The Theory of Games and Economic Behavior* that first appeared in 1944, and was later revised in 1947 and 1953. Game theory is an approach to developing the best strategies in areas such as economics and war to beat a competitor or enemy. [Of course, one possible strategy is to convert an enemy into an ally, or a competitor into a partner!]

A game is defined by a set of rules that specify the players, their desired goals, allowed interactions, and a method of assessing outcomes. There can be one or more goals with different levels of importance. The players adopt strategies, and the interactions of the "moves" based on those strategies lead to outcomes which may or may not be consistent with the players' goals. Complex games involve look-ahead strategies that address the different possible moves that an opponent could make. It is important to try to understand an opponent's goals in order to maximize the probability of a favorable outcome. Games can

Games should involve look-ahead strategies

[1]From Steven J.Brams, "Theory of Moves,"*American Scientist,* **81**, 562-570, November-December 1993.

be sequential, with player interaction allowed between moves.

OBJECTIVES OF THIS GAME

The Biomedical Prosperity Game™ is designed to accomplish the following specific and general objectives:

SPECIFIC:

- Identify advanced/critical technology issues that affect the cost and quality of health care.
- Explore the development, patenting, manufacturing and licensing of needed technologies that would decrease costs while maintaining or improving quality.
- Identify policy and regulatory changes that would reduce costs and improve quality and timeliness of health care delivery.
- Identify and apply existing resources and facilities to develop and implement improved technologies and policies.
- Begin to develop a Biomedical Technology Roadmap for industry and government cooperation.

GENERAL:

- Develop partnerships, teamwork, and a spirit of cooperation among health care consumers and providers, researchers, regulatory agencies, industry, government, and other stakeholders in the health care system.
- Increase awareness of the needs, desires and motivations of the different stakeholders.
- Bring conflict into the open and manage it productively.

Freedom rings where opinions clash. - Adlai E. Stevenson

- Explore long-term strategies and policies.
- Provide input for possible future legislation.
- Stimulate thinking.
- Provide a potentially life-altering learning experience.

The game will explore biomedical technology simultaneously from three points of view. The **consumers** represent patients and their problems, including diseases and disabilities, costs for services as well as insurance, treatment options, and overall quality of care and quality of life. All **providers** and related organizations involved in health care are represented including doctors, hospitals, research organizations, manufacturers, and the problems they encounter such as costs, delivery systems, regulations, research and development, etc. Since health care costs consume 14.1% of US gross domestic product and 18.5% of total public spending, this area is of utmost importance to the **nation**. Health care costs are also reflected in the costs of all products and services, and affect our ability to compete internationally. Hence, private and public representatives of national stakeholders are included in the game including legislators, insurers, government customers and payers, lawyers, etc.

Over the course of the game, patients will develop diseases, disabilities, and aging problems that will be treated by doctors and nurses using available technologies, and new technologies developed during the game. Suppliers, manufacturers, congressional representatives, researchers, national laboratories, regulators, lawyers, insurance companies, finance, and news media will all play their real-life roles.

Results of the game will be combined with the expertise of a large group of health care professionals and stakeholders to help create a

Technology Roadmap for the future of the health care system in biomedical engineering.

GAME CONCEPT

Teams:

The game incorporates eleven basic teams:

Consumers that represent patients from all demographic groups in the US.

Two Provider teams. One represents independent physicians and hospitals and IPAs (Independent Practice Associations) who bill on a fee-for-service basis, and the other represents Health Maintenance Organizations (HMOs).

Insurance Payers that represent private and public (Medicare, Medicaid) insurance organizations. Large companies are also represented in their role of insurance provider.

Legislators representing the US Congress and State legislatures.

Suppliers/Manufacturers representing companies that make and sell biomedical devices and equipment.

US Food and Drug Administration and State Regulators

Planning/Funding Organizations that represent the private and public (including the Department of Defense, National Science Foundation, private foundations, etc.) organizations that provide resources to fund research and development of new biomedical technologies and that perform strategic planning.

Universities/Laboratories that perform the research and development of new technologies.

Lawyers that provide consulting and legal assistance to all parties.

Control Team: Directs the conduct of the game, resolves all disputes, and plays all other roles required in the game including financial institutions, news media, scientific publications, foreign countries, polling, computing, etc.

Players:

Every Prosperity Game™ is unique because the outcomes depend on the players. Players have been selected to represent their real-life roles as faithfully as possible. Their creativity and commitment to the simulation determine the success of the game. A list of the players and their team assignments is given in Appendix B. The game schedule is described in Appendix C.

Game Description:

The primary game objective is to explore existing and future biomedical technologies, with emphasis on lowering costs and maintaining quality. This exploration requires highly skilled players with a strong knowledge of the biomedical field, the ability to read and digest a significant amount of information, and the confidence to make decisions, observe their consequences, and alter their decisions accordingly.

The play ran from January, 1996 to the end of 2003, a compression of eight years into one and a half days. This time compression of 2000:1 (1 game minute = 1.5 days) means that many aspects and issues were treated very approximately. No significant accuracy is claimed for estimates of research and treatment costs or quality of care. The game design was only intended to qualitatively capture these concepts to assist decision makers in understanding today's environment and the possibilities of significant future improvements. This learning process was used to build a Biomedical Technology Roadmap that incorporates technical and policy changes that will ultimately benefit the nation with lower costs and high quality health care.

The central theme of the game, as in real life, was the relationship between the patients (consumers) and the medical treatment world (providers) in the event of accident, illness, disability or aging. The patients were provided with Disease/Disability (D/D) cards that describe their assigned age and symptoms. The D/D cards list: treatment options that are available in 1996; placeholders for new technology-based treatments that may be developed during the play; the various possible outcomes and associated probabilities; and estimates of direct treatment costs and long-term costs to society by either dying, remaining ill, or completely recovering and returning to the workforce. As the game progressed in time, additional technology treatment options were created to replace the placeholders on the cards.

The game focused on the major diseases, disabilities and accidents that provide opportunities for improving quality and lowering costs through applications of new technologies. The players were encouraged to develop innovative technologies across a broad set of biomedical technology areas. These areas were grouped into the following preliminary categories as a starting point for the players' consideration:

Technology Areas:

1. Advanced diagnostics
2. Assistive technologies for the elderly and disabled
3. Energy delivery devices (lasers, ultrasound, etc.)
4. Health Informatics
5. Microelectronics and sensors
6. Minimally invasive therapies
7. Outcomes research tools
8. Telemedicine

These technology areas include only medical devices, diagnostic systems, and health care information systems. Technology includes the results of engineering analysis, design, and materials; and product development entailing hardware (electronic, mechanical, electro-mechanical), software, and systems approaches. Drugs were not be investigated in this game. However, if a team were to decide that drugs was the only viable approach, we would note that in the game records.

Similarly, policy issues can be proposed, discussed and implemented throughout the game. Our goal was not to reform the entire medical system. Rather, these policies should address ways to improve the processes involved in funding, developing, testing, approving, and marketing new technologies with special emphasis on reducing costs while increasing the quality of care. A tentative list of policy areas might include:

Technology-Related Policy Areas:

1. Legislative changes; regulatory improvements and reforms
2. Government incentive programs
3. Information surety and security
4. Tort liability reform
5. Metrics and systems for evaluating the costs and increases in health care quality resulting from the introduction of new technologies
6. Funding allocation systems

Several diseases and/or disabilities (due to illness, accidents, battlefield casualties, or aging) were defined for each of the technology areas, and provided the basis for the D/D cards. The cards addressed at most four possible generic outcomes with associated probabilities and returns on investment for working life up to age 65 (these outcomes can be modified according to the particular disease/disability); life expectancy was assumed to be 75 for all patients. D/D cards were given to individual consumers describing

their condition and treatment options. In addition, the Provider teams were given "team" D/D cards representing global health care problems that needed to be solved by their teams (e.g., breast cancer screening or disaster evaluation and triaging).

For the first part of the game, only current technologies were available for treatment. All new technologies needed to be developed either through Toolkit Options (q.v.) or through the natural processes of the game (i.e., research, development, patenting, licensing, clinical testing, regulatory approval, manufacturing, marketing, gaining insurance coverage, etc.).

At the start of the game, the Provider teams were given copies of all D/D cards with their detailed information. During play, the doctors provided care to their patients, choosing among the available options, taking into consideration the patient's insurance and income, overall health, and any other considerations deemed important.

For the latter part of the game, the Control team was to keep the providers abreast of the newly developed and licensed technologies, including costs, and possible outcomes and their probabilities. All new technologies were to include costs associated with research and development.

The game simultaneously explored two dynamic systems: the health care delivery system and the technology development and marketing system. The delivery system encompasses three tightly knit teams: consumers, providers and insurers (the "triad"). The consumers have discretionary income that can be used to purchase health insurance and save for personal expenses such as co-payments. The private insurers spread the risk among the mix of healthy and sick people and seek to make a profit. Government insurers cover a segment of the population including the elderly or poor. Providers deliver health care directly to their patients and also seek to profit from their labors.

The technology system encompassed the research funders and doers, the suppliers and manufacturers, and the regulatory agencies. Their objectives were to create new technologies and products that are safe and effective, and deliver them to the health care providers.

The legislators strongly influenced both systems. They provided a large fraction of the money needed in the health care triad, as well as supporting research and development of new and improved technologies. They could also set national objectives and policies for a large fraction of the health care expenditures.

Lawyers could also play roles in both systems. They could be involved in litigation between any of the stakeholders (e.g., malpractice suits, product liability litigation, etc.). They could also assist in securing and defending intellectual property rights, lobbying, and mediating disputes.

The two dynamic systems could have other possible crossover connections. The providers might purchase new technology products from the suppliers; the suppliers might assist the providers in obtaining insurance coverage for new treatment options; the patients might try to influence specific legislation, or even invest in certain technologies. Each system had its own currency (green for the triad, yellow for technology development) to meet its primary objectives, but crossovers were allowed using simple conversion factors.

The next section provides an overview of the flow of the game and roadmapping sessions.

More details on the game description and initial conditions are provided in Appendix A.

PLAYING THE GAME

The Prosperity Game/Technology Roadmap exercise included seven sessions or distinct time periods. Sessions 1 through 4 comprised the Prosperity Game simulation. It explored empathic and learning experiences, collaborative and competitive interactions, experimentation, decision making, and innovation. The game and life experiences of the players were collected, discussed, prioritized and documented in the roadmapping exercises of Sessions 5 through 7. A final debriefing allowed the teams to share their experiences with the entire group.

The primary "move" in the game was represented by an agreement or contract. These agreements were negotiated among two or more teams and needed to represent an exchange of value for value. Appendix A shows the form used for documenting agreements. No agreement was official until signed by all parties and the Control Team, with representatives of all parties present. If the agreements involve uncertain future outcomes, these were determined probabilistically by the Control team for the final execution. The agreements were accompanied by the amount of money being transferred between partners. Two secondary "moves" included investments in Toolkit options, and D/D cards with their associated outcomes, costs, and quality evaluations.

All teams were provided with a list of near-term and long-term challenges (see Appendix A). This information, coupled with the experience and expertise of the players, launched them into the real-world simulation of the game. The game is "won" by successfully meeting the prescribed challenges and accomplishing the long-term objectives of the teams and individual players. Circumventing the game is not winning. Players should seek to accomplish their goals following the most realistic alternatives available.

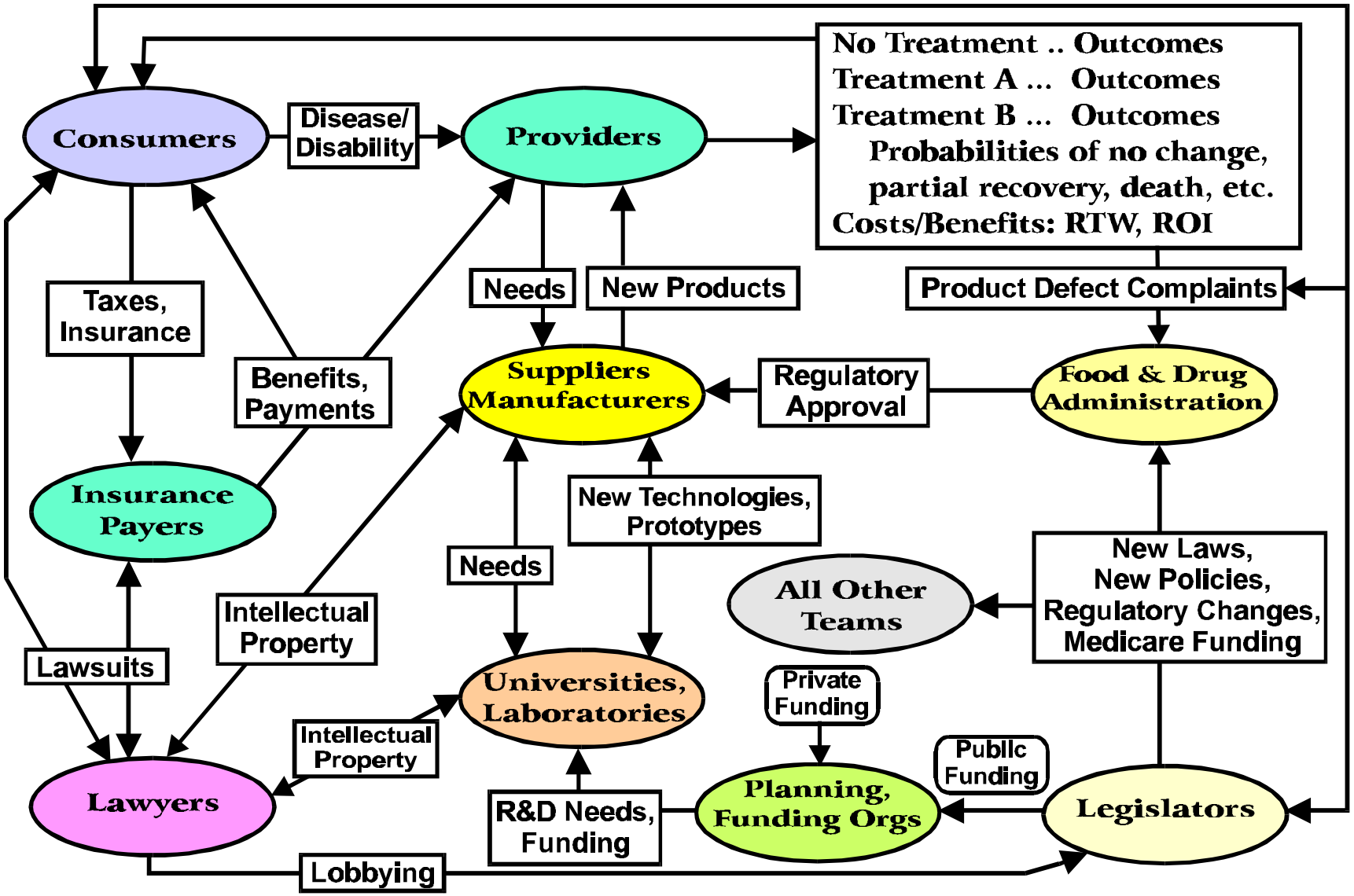
Session 1: 1996-1997: This session was for strategic planning and organizing to best deal with the coming events. Players were to decide on groundrules for making decisions, who will play what roles on the team, assignment of responsibilities, processes for accountability and correcting errors. They were to resolve outstanding questions about the game, review their current state and where they would like to be in 8 - 10 years, discuss their initial challenges, and add others of their choosing.

Session 2: 1998-1999: Game play proceeded with funding and money flow, D/D cards, consumer/ provider/ insurer interactions, research and supplier activities, role-playing, interaction, and negotiation. Toolkit investments needed to be completed by the middle of this session.

Figure 1 illustrates some (not all) of the possible interactions that could occur during Sessions 2 - 4. This experiential process developed the relationships and provides the inputs and innovative thinking that are used in the development of the Biomedical Technology Roadmap.

Session 3: 2000-2001: Successful Toolkit options were be announced and implemented into the game. Session 2 activities continued. Consumers selected new D/D cards depending on previous outcomes. Doctors could use any new technologies developed (and FDA-approved) over the last two years. Policy

Figure 1. Schematic of Some Possible Team Interactions



changes in insurance, regulatory requirements, etc. were also be incorporated into the game. Champions of particular technologies and policies were to pursue the agreements necessary to bring their ideas to fruition.

Session 4: 2002-2003: Session 3 was repeated, updated two more years. The simulation ended at the end of Session 4. Late advances and successes were documented in the final report of the game.

Session 5: Identify Problems and Solution Areas: This session began the roadmapping efforts. Based on game and life experiences, each team identified the most important issues, problems, challenges and potential solutions for employing technologies and related policies in reducing costs and increasing quality. These issues were prioritized and then the top one or two issues and their rationales were presented to the entire group in plenary session.

Sessions 6-7: Roadmapping Technologies and Policies: The information produced in Session 5 was assembled into a useable form. The team tables were relabeled according to technology and policy areas. Players moved to those tables that were of primary interest to them, based on the preferences expressed at the end of Session 5. Players then began to flesh out their thinking on the key elements of a Biotechnology Roadmap. Tables were then reconfigured back to the original team designations.

Outbriefings: Players prepared a final briefing. Each team selected a spokesperson. Topics were: Team issues and objectives; Interfaces with others (collaborative, competitive, other); What was learned; and Conclusions. Each team was allowed no more than 5 - 7 minutes for the presentation.

Wrap up and final polling: Players answered questions, filled out evaluation forms and signed up for the roadmap follow-on efforts.

DISEASE/DISABILITY CARDS

The D/D cards served many functions in the game. They introduced the players to the important diseases and disabilities in the health care system, listed the costs of conventional and advanced treatment options, estimated the costs to develop new technologies, illustrated probabilities of positive and negative patient outcomes and how these might improve with advanced technologies, and estimated the potential return on investment which is dominated by the ability of the consumer to return to the productive working population or to reduce the fiscal drain on the health care system.

There were 32 D/D cards available in the game, as shown in Table 1. Twenty four of these apply to individual consumers (patients) and eight to the provider teams. Half of these patients were assumed to be privately insured through independent providers or HMOs. The other twelve were elderly, poor or military, and were insured by government programs (e.g., Medicare and Medicaid). All cards applied to either males or females, since the bill payers may be either regardless of the nature of the disease.

D/D cards 6, 7, 8, 21, 22, 25, 27, and 30 applied to the Provider teams. These cards focused on the potential benefits of diagnostics and prevention in the early detection of diseases (e.g., cancer screening). They also explored the process for adopting new procedures in a conservative HMO system, and the approach to dealing with major disasters.

Table 1. D/D CARDS, INSURANCE TYPE, AND PATIENT DESCRIPTIONS

DD01	Private	Adverse Drug Reaction
DD02	Private	Diffuse Atherosclerosis
DD03	Gov.	Massive Battlefield Injuries
DD04	Private	Knee Osteoarthritis
DD05	Gov.	Blindness
DD06	Provider	Breast Cancer Screening
DD07	Provider	Cancer Screening Interpretation
DD08	Provider	Colon Cancer Screening
DD09	Private	Heart Replacement
DD10	Private	Insulin Dependent Diabetes Mellitus
DD11	Gov.	Hearing Loss
DD12	Gov.	Hip Fracture
DD13	Gov.	Home Bound Patient
DD14	Private	Ischemic Heart Disease Diagnosis
DD15	Private	Ischemic Heart Disease Treatment
DD16	Gov.	Kidney Failure
DD17	Gov.	Liver Replacement
DD18	Private	Lung Cancer
DD19	Private	Lung Replacement
DD20	Gov.	Medication Compliance/Monitoring
DD21	Provider	New Information Dissemination
DD22	Provider	New Procedure Adoption
DD23	Private	Paraplegic
DD24	Private	Premature Birth
DD25	Provider	Prostate Cancer Screening
DD26	Gov.	Quadriplegia
DD27	Provider	Skin Cancer Screening
DD28	Gov.	Tissue Diagnosis
DD29	Private	Unknown Critical Information
DD30	Provider	Disaster Evaluation and Triaging
DD31	Gov.	Burn debridement
DD32	Gov.	Threatened early delivery

Measuring Quality Of Care:
In the game, quality of care was subjectively measured by a short questionnaire supplied to the patients and their primary physicians. Each was to answer the questions independently. Table 2 was incorporated on the back side of each D/D card.

TOOLKIT OPTIONS

Players have two ways in which they can alter the future. One is the conventional approach that involves negotiations and contracts among the stakeholders in a realistic process that evolves within the game. The other way is through Toolkit Options. These are a list of technology and policy options that teams and players can invest in. We have created a list of these options and assigned a total resource investment that would yield a 50% probability of success. Teams determine which of these technology and policy options are important for their desired futures. Each team is given finite Toolkit resources. They invest their own resources and encourage others to partner with them, according to their priorities. Teams are also allowed to create their own Options. "Experts" on the Control team will assign mean investments that would yield a 50% probability of a successful outcome. All investments must be completed and turned into Control by the middle of Session 2. The results will be published at the start of Session 3. All successful technologies and policies will be implemented and become part of the environment of the game.

Table 2. EVALUATING THE QUALITY OF CARE

PATIENT'S (or PHYSICIAN'S) QUALITY CARD

Patient/Doctor: _____

Date: _____ Time: _____

Disease/Disability Card No.: _____

Please circle most appropriate rating:

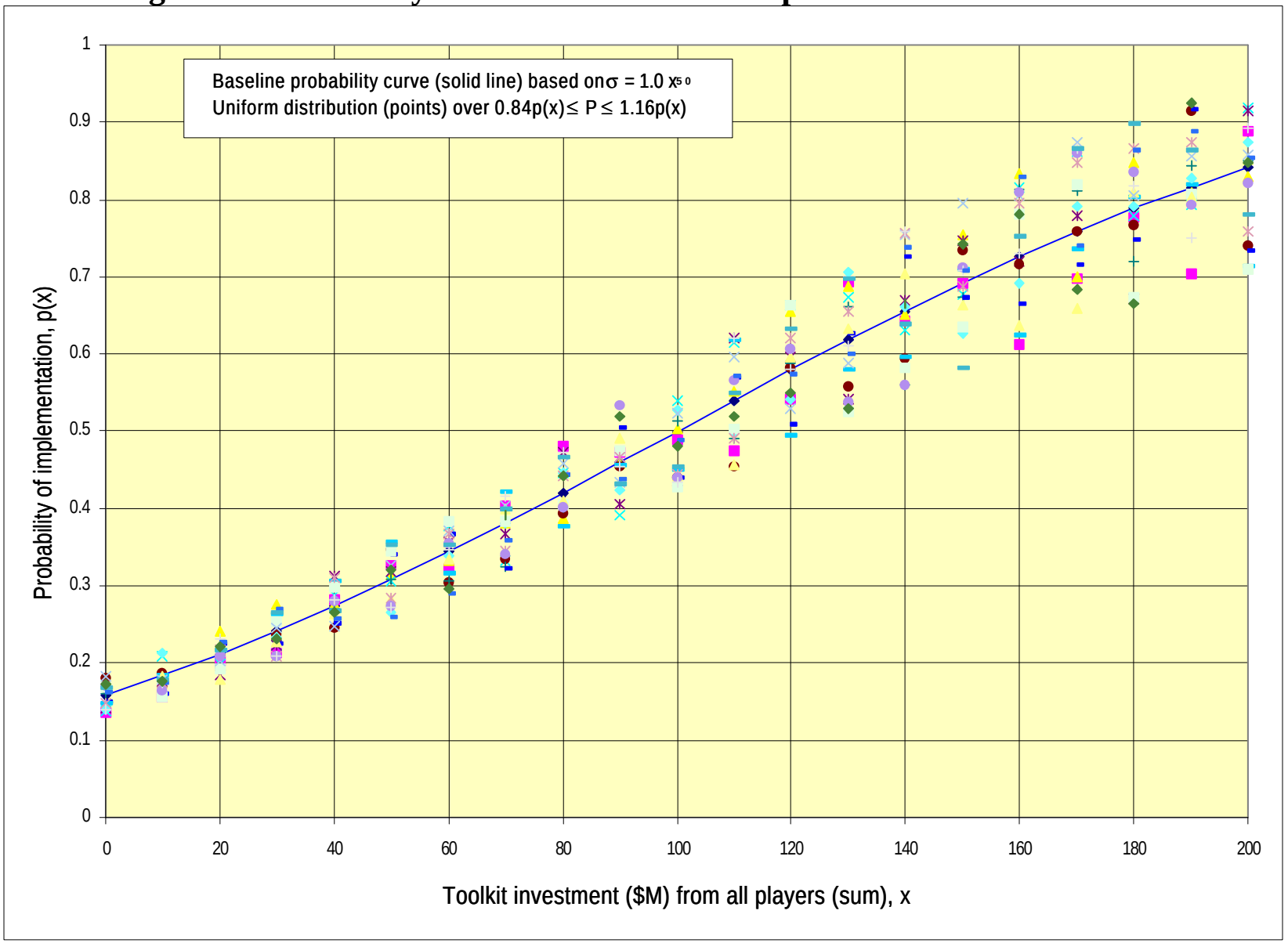
1 = very bad 2 = bad 3 = neutral 4 = good 5 = very good

Cost was reasonable?	1	2	3	4	5
Treatment was efficient?	1	2	3	4	5
Treatment was appropriate?	1	2	3	4	5
Treatment option minimized risk?	1	2	3	4	5
Was technology adequate?	1	2	3	4	5
Did the treatment improve your quality of life?	1	2	3	4	5
Overall satisfaction:	1	2	3	4	5

Toolkit Options provide an indication of some possible advances in technology, or policy changes that might significantly improve health care quality and lower costs. The Toolkit is a shortcut to accomplishing important objectives outside the normal highly expensive and time consuming processes. They are also meant to encourage collaboration among the many stakeholders and to indicate the highest priority technology and policy objectives of the players. Toolkit resources are not available for any other uses in the game. Investments made in unsuccessful options are permanently lost. *Toolkit investments are the responsibility of each team.* Each team must turn in its own Toolkit spreadsheet. The Toolkit options will also be posted on a wall board. Players are encouraged to enter their investments on the board, and observe the investment patterns of other teams. Since the board is unofficial, no team can hold another team liable for mistakes or investing differently from the board entries. However, formal agreements can be made between teams on investments (with Control's signature); violations of those written agreements can be litigated.

The outcomes of the Toolkit investments are determined probabilistically as shown in Figure 2. First, the baseline probability will increase with increasing investment following a normal distribution with mean x and standard deviation $\sigma = x$. Hence, an investment of twice the mean, \$200M, would yield a success probability of 0.84. To take into account factors other than total investment, a uniform distribution is superimposed on the normal distribution to reflect uncertainties and risks in the real world for accomplishing major technology or policy breakthroughs. This uniform distribution can increase or decrease the baseline probability by as much as 16%. The total investments from all teams are fed into the computer and the success or failure is determined by this process. A list of technology and policy options is shown in detail in Appendix H.

Figure 2. Probability of Successful Toolkit Option for Cumulative Investments



RESULTS AND OBSERVATIONS

Summary and Objectives

Prosperity Games are games of discretion and judgment and, therefore, need to be analyzed in the context of human interactions. Analysts observed each team's actions and recorded their understanding of the underlying dynamics, motivations and actions that led to the play within the game.

The players were instructed in the handbook and in the initial briefing to develop strategies and plans to accomplish both the game's objectives and their personal goals. Various strategy types were presented with indications as to which might prove more robust and penetrating. They were also encouraged to take risks and to innovate.

Take risks and innovate

The success of a Prosperity Game depends on the game design and execution, but most importantly on the players themselves. In all previous games we have observed that those players who most highly value the objectives of the games derive the most benefits. The lessons learned in the game must be applied to real life in order to be of value.

This was a highly complex game because of the large number of stakeholders, the three points of view (patients, providers and nation), and the five ambitious objectives.

Health Care Costs

The primary objective of the game was to identify advanced and critical technology issues that affect the cost and quality of health care. This objective was met in the game by defining new technologies and making these available for treatments of patients. Availability and prioritization was determined by the investments of the various teams of their limited resources (dollars). Costs and quality were estimated as part of the simulation of patient treatment and recovery.

From the perspectives of both the patients and the nation, total costs include both the costs of treatment and subsequent costs (or income) resulting from the patient's prognosis. A cost-benefit analysis was performed to estimate which proposed technologies would provide positive returns on investment when compared to current treatment and diagnostic options (see **Health Care Costs**, p. 17).

Thirty-two diseases, disabilities, and diagnostics were evaluated in the game. The authors developed an algorithm to estimate the costs and benefits of investments in new biomedical technologies. Almost all new technologies resulted in lower consumer and societal costs, with high returns on R&D investment; however, ischemic heart disease treatment for an elderly patient (age 68) and new premature birth technologies resulted in negative returns on investment over ten years. Many net benefits were extremely high, up to several tens or hundreds of billion of dollars, compared to R&D investments of tens to hundreds of millions. When true age distributions were factored in, there were still very large 10-year returns; e.g., $14B for breast cancer screening, $29B for new diabetes technologies, and about $1B for heart disease. Investments in technologies associated with the elderly and for new diagnostics and treatments for cancer showed great promise for large returns.

Health Care Quality

Health care quality was subjectively measured by surveying the patients and providers. Doctors from both Provider teams felt that the treatments they gave were much more appropriate and reduced risk more than did the patients. Doctors were also more satisfied with the outcomes than were the patients. The small sample study here suggests that an improved

understanding of the quality of life and surrounding issues in health care would result from a well-conducted large-scale study of the issues discovered in this game (see **Health Care Quality**, p. 28**)**.

Investment Priorities

Several mechanisms were used to determine the players priorities in desired technologies and policies. 59 possible technology investments were provided in the Toolkit. They chose to make investments in 16 of these, of which 11 passed in the initial investment period. They later reinvested in two options that had previously failed, and four more that had not received previous investments. Hence, they successfully implemented 17 out of 20 Toolkit options.

Of the ten original policy options, six received investments and two passed. The players also passed two new policies.

Health Informatics and Outcomes Research Tools drew significant investments. Only computer-guided energy delivery systems were important for Minimally Invasive Therapies. Advanced Diagnostics, Telemedicine, and Assistive Technologies were important areas of interest and investment. Internal Organ-Related technologies drew investments in excess of $1.5 billion, the largest of any category based on dollars invested. The second largest dollar investment was in Outcomes Research tools at $1.32 billion.

Total investment in policies was relatively small at $200 million. The largest single investment was in establishing private savings accounts for health care. Many other investments were aimed at improving the FDA regulatory process.

The players expressed a strong desire to obtain information and make it readily available to both patients and doctors; there were ten such investments for a total of $1.56 billion.

Roadmaps

A major objective of the game was to begin the development of technology roadmaps. The players were asked to describe the most important problems and issues based on both the game and their real-life experiences. Those issues were then mapped into "solution areas" to find commonalities and to estimate priorities. Hence, the game provided several ways in which the players' estimations of relative importances could be assessed: Toolkit investments, contracts and agreements, and descriptions of issues. Based on all these metrics combined, the players ranked preventive medicine as the most promising area for research, followed in order by Health Informatics, Telemedicine, Information Surety and Security, Assistive Technologies, Outcomes Research Tools, Microelectronics and Sensors, and Minimally Invasive Therapies.

Team Dynamics

Based on player evaluations, this was the most successful game conducted to date. Nevertheless, the teams varied in their degrees of self-assessed success. The Consumers "learned" that money dominates everything, and that technology is swamped by other factors (financial, social, political). They demonstrated a strong desire for self- and home-care.

The Independent Providers formed a multi-specialty group with a focus on creating effective care delivery units, maintaining quality of care, and increasing efficiency. The HMO team had similar objectives. However, early in the game they signed a contract with the Insurers that proved disastrous in that they could not cover the costs associated with providing care. They concluded that new

technologies were not as important as using existing technology better.

The Insurer team struggled with their tasks. They blamed the game for not understanding the insurance industry.

The Legislators passed enabling laws to reduce barriers and encourage market development. They believed that they created a workable governing process, assigned priorities and streamlined the FDA process.

The Suppliers/Manufacturers gathered market intelligence to determine their technology investments. Several product lines were developed: home healthcare, cell-cultured replacement organs, an RF cancer treatment, biogenetic markers, and an alliance for standards and data transfer.

The FDA team tried to work with the other groups to facilitate the approval process. They identified for key areas: risk versus benefit, collaborations, regulatory processes and information. Their goals were to protect public health and ensure the safety and effectiveness of medical devices.

The Planning/Funding team was hampered throughout the game by internal disagreements about telemedicine; the team never became unified.

The Universities/Labs defined pathways to increase funding and identify technologies for improving quality of care, quality of life, and improved accessibility for underserved patients. They created a Strategic Health Care Office for coordinating a national program on biomedical R&D.

The Lawyers initially struggled with their role. However, poorly structured contracts and illegal actions soon brought them into the mainstream of the game. The team felt they were successful in lobbying the legislature, obtaining intellectual property rights, and representing their clients.

Health Care Costs

One of the specific objectives of this Biomedical Prosperity Game was to explore the development of needed technologies that will decrease costs while maintaining or improving the quality of health care. A cost-benefit analysis has been performed using the game data to provide a preliminary indication of which proposed technologies will provide positive returns on investment when compared to current diagnostic and treatment options.

The introduction of new technology in most fields of endeavor has reduced costs. This has not necessarily been true in the field of health care. However, the costs of diagnosis and treatment alone do not adequately describe the fiscal impacts of new technology in health care. Rather, the full impact of new technology is most likely to be seen in an increased return to the productive working population or decreased fiscal burden on the health care system. Thus, any cost-benefit analysis must include patient productivity after diagnosis and treatment, even though these benefits may not accrue directly to the health care system.

Thirty two disease/disability (D/D) cards were available in the game. These cards served several purposes in game play, and contain the data necessary to perform a rudimentary cost-benefit analysis. The D/D card for breast cancer screening is shown here in Figure 3 as an example, and contains data on treatment costs, technology development costs, outcomes and their associated probabilities, lengths of recovery, and productivities per

Figure 3. D/D Card for Breast Cancer Screening.

CARD 6	BREAST CANCER SCREENING							FREQUENCY ~ 10M-20M/yr.	
PROVIDER TEAM	In order to reduce mortality, breast cancer screening is vital. Assume average age is 50.								
Team: INDEPENDENTS									
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Under 65 Productivity/ yr/patient	Over 65 Productivity/ yr/patient
Continue current mammograms	$300	$0	None	0.20	0.00-0.20	5		0	$0
			Poor	0.30	0.21-0.50	10		($20,000)	($20,000)
			Partial	0.30	0.51-0.80	15		$10,000	($10,000)
			Complete	0.20	0.81-1.00	15	25	$30,000	($5,000)
Mobile cancer screening units at	$300	$40E+06	None	0.10	0.00-0.10	5		0	$0
patients' locations			Poor	0.20	0.11-0.30	10		($20,000)	($20,000)
			Partial	0.40	0.31-0.70	15		$10,000	($10,000)
			Complete	0.30	0.71-1.00	15	25	$30,000	($5,000)
Non-invasive scan and advanced image	$2,500	$180E+06	None	0.10	0.00-0.10	8		0	$0
diagnostic screen			Poor	0.20	0.11-0.30	13		($20,000)	($20,000)
			Partial	0.20	0.31-0.50	15	18	$10,000	($10,000)
			Complete	0.50	0.51-1.00	15	25	$30,000	($5,000)
Portable quick microwave screen	$600	$100E+06	None	0.03	0.00-0.03	10		0	$0
			Poor	0.07	0.04-0.10	15		($20,000)	($20,000)
			Partial	0.10	0.11-0.20	15	20	$10,000	($10,000)
			Complete	0.80	0.21-1.00	15	25	$30,000	($5,000)

year of recovery in dollars for patients of working and retired ages.

Return on investment has been calculated for each treatment option for most of the D/D cards using the equation in the box on the next page.

The form of this equation is simply productivity minus treatment and technology development costs as a function of time. The complexity of the equation comes from accounting for different outcomes and probabilities (p_i), the potentially different numbers of diagnostics (*ND*) and treatments (*NT*) for the same condition, and age demographics (a_j).

The assumptions and estimations used in the return on investment calculations are as follows:

- All outcomes have been assumed to fall into the following four categories: none (or death), poor, partial recovery, and complete recovery. These four generic outcomes may not be enough to accurately cover the outcome space for some conditions and treatments.
- Future treatment options are based on both current research and futuristic ideas and may or may not be realistic.
- Outcome probabilities for both current and future technology-based treatment options

$$ROI(t) = \sum_{j=1}^{n}\left(\sum_{i=1}^{4} p_i \; P_i(a_j)\, T_i(t) \; NT_j - C_T \; ND_j \right) - C_D$$

where $ROI(t)$ = return on investment for one year's patients as a function of time for a particular treatment option
t = time from initial diagnostic or diagnostic/treatment [years]
p_i = probability of outcome i
$P_i(a_j)$ = productivity (as a function of age) associated with outcome i [$]
a_j = (a_{init} + t) age for age group j [years]
a_{init} = initial age for age group j [years]
$T_i(t)$ = minimum of (t, L_i) [years]
L_i = length of recovery associated with outcome i [years]
NT_j = number of patients receiving treatment for age group j
ND_j = number of patients receiving diagnostic for age group j
C_T = cost of initial diagnostic or diagnostic/treatment [$]
C_D = new technology development cost [$]

are estimated and not based on data. Most treatment options and their estimated probabilities were provided by Dr. Fidel Davila, Scott and White Clinic, Temple, Texas.

- Future treatment options have higher probabilities for partial and complete recoveries than do current treatments.
- Technology development costs for future treatment options are estimated. These estimates came from collaboration between the game designers and Dr. Davila.
- No co-factors nor multiple diagnoses are considered.
- Frequency of occurrence data was estimated from commonly available health statistics.
- For most calculations, no age demographics were considered. All patients for a given condition were assumed to be the same age.
- Productivity values were estimated by the game designers.

The assumed outcomes and associated productivity values are as follows:

	Productivity/year	
Outcome	Age <65	65+
None (death)	$0	$0
Poor (invalid, no work)	-20K	-20K
Partial (part-time work)	10K	-10K
Complete (full recovery)	30K	-5K

These productivity numbers reflect a national economy rather than just a health care cost viewpoint, and are based on certain assumptions. For an outcome of death there should be no productivity nor further fiscal drain on the system, thus $0 productivity. For a poor outcome, the patient will not be able to work, will require constant care, and is thus a drain on the system. We estimate constant care to cost $20K/year on average. For partial recovery, a person of working age will be productive part-time (assume $10K/year), while a retired person will require some care. Medicare spending for those reporting poor and good health status were approximately $7K and $3K per capita, respectively in 1991.[2] Assuming that partial recovery lies between

[2] National Center for Health Statistics. **Health United States, 1994** Hyattsville, MD: Public Health Service. 1995.

poor and good health and adjusting for the increase in health care costs since 1991 gives a productivity of near $-10K/year. For a complete recovery, a person of working age will resume full productivity (assume $30K/year), while a retired person will still have a negative productivity due to the costs of basic and preventive medical care. Medicare spending for those reporting excellent health was only half per capita of those reporting good health. Thus, we assume a productivity of $-5K/year, which is half that of the partial recovery case.

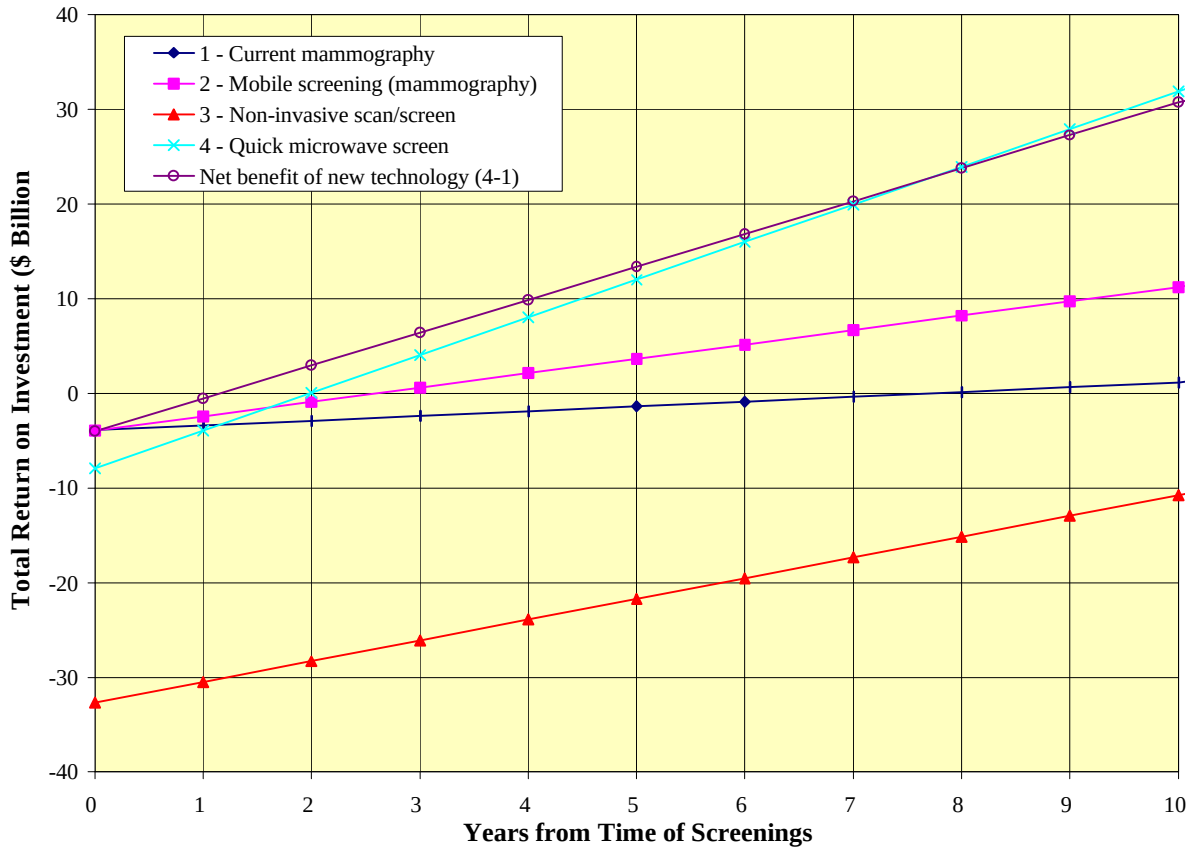
These productivity values were used for the majority of D/D cards. However, there are some cards for which the values were modified as made sense; for example, annual costs for treatments required for the foreseeable future have been accounted for in the productivity values. Copies of all D/D cards with their productivity values are given in Appendix F.

We make no claim that the return on investment calculations are accurate. Many of the input values have been estimated due to lack of data. Yet, the estimates have been made by those with proper background and expertise. Thus, despite the lack of data, this analysis is likely to show the same trends that would result from valid data.

The process and outcomes of a return-on-investment analysis are illustrated here using the breast cancer screening D/D card as an example. ROI as a function of time (years from time of screening) was calculated for each of four treatment options: 1) current mammography; 2) mobile screening capability using current mammography; 3) a new non-invasive scanning with advanced image screening technique, and; 4) a new portable quick microwave-based scanning and screening technique. The assumed outcomes and associated probabilities are shown in the D/D card (Figure 3), along with the screening and technology development costs. The numbers of screenings (ND) and new cancers detected (NT) were assumed to be 13,000,000 and 169,000, respectively. All of these screenings and diagnoses were assumed to occur during one year and all patients were assumed to be 50 years old. For the ROI calculation, productivity was only calculated for the new cancer patients, since they were the only ones at risk, while the diagnostic costs were applied to all those who were screened. Treatment costs for the new cancer patients have not been explicitly considered here, but are expected to be small compared to the productivity numbers over a period of many years. This is especially true if new techniques allow earlier detection and less costly treatment of cancers, as is assumed in this analysis.

The returns on investment for each of the four treatment options are shown in Figure 4 as a function of time from the initial screening. The net benefit of new technology is also shown and is the difference in ROI between the best new technology and the current technology, which in this case is the difference between treatment options 4 and 1. As shown in Figure 4, three of the treatment options have positive returns on investment in the billions of dollars over a decade; because of the large assumed technology development and treatment costs for the non-invasive scan and advanced imaging diagnostics (#3), this technology requires more than ten years to pay back these costs. The net benefit of the “best” new technology (#4, quick microwave screening) over 10 years is over $30 billion. This new technology option also shows a net benefit after only one year due to the increased productivity from the better outcomes afforded by early detection of cancers.

Figure 4. Returns on Investment from Breast Cancer Screening Alternatives. (13M screens, 169K cancers in one year; all 50 yr. olds)

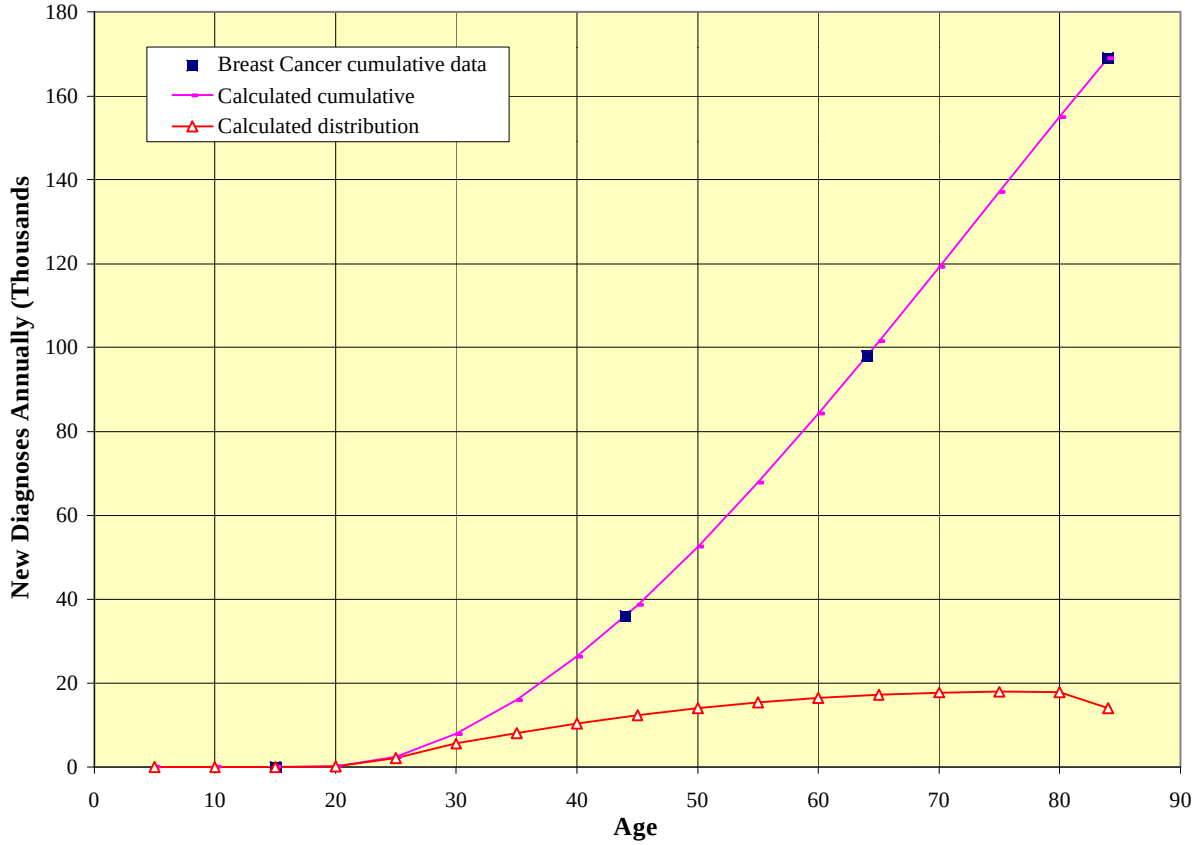


The outcomes change substantially when true age demographics are accurately reflected in the calculations. Age demographics for new breast cancer diagnoses are shown in Figure 5. The original data are shown in cumulative distribution form as the four square symbols.[3] We assumed an upper age limit of 84 on the fourth data point, which was for ages 65 and older. However, this has no effect on our calculations, since productivity values are the same for all ages over 65. The data were curve fit to obtain intermediate cumulative distribution points, from which the distribution by age was calculated. Each point on the distribution covers an age span of 5 years; for example, the data point at 45 years is for the age span of 41-45 years.

The returns on investment for breast cancer screening using true age demographics are shown in Figure 6 as a function of time from the initial screening. Returns on technology investments in this case are significantly reduced. The current, and the first two new treatment options (#2, 3) have negative returns on investment, while technology option 4 has a positive return of $3.1 billion over 10 years. The net benefit of this new technology over 10 years is $14.4 billion, which is only half that seen when no age demographics were applied. This new technology option also shows an immediate net benefit due to the negative

[3] National Center for Health Statistics.**National Hospital Discharge Survey: Annual Summary, 1993** Vital Health Stat 13(121). 1995.

Figure 5. New Breast Cancer Diagnoses as a Function of Age.



return on investment for the current treatment option.

Despite the negative return on investment for technology #2, it still is cost beneficial compared to current treatment options. Technology #3, however, will never pay back its investment costs in this model.

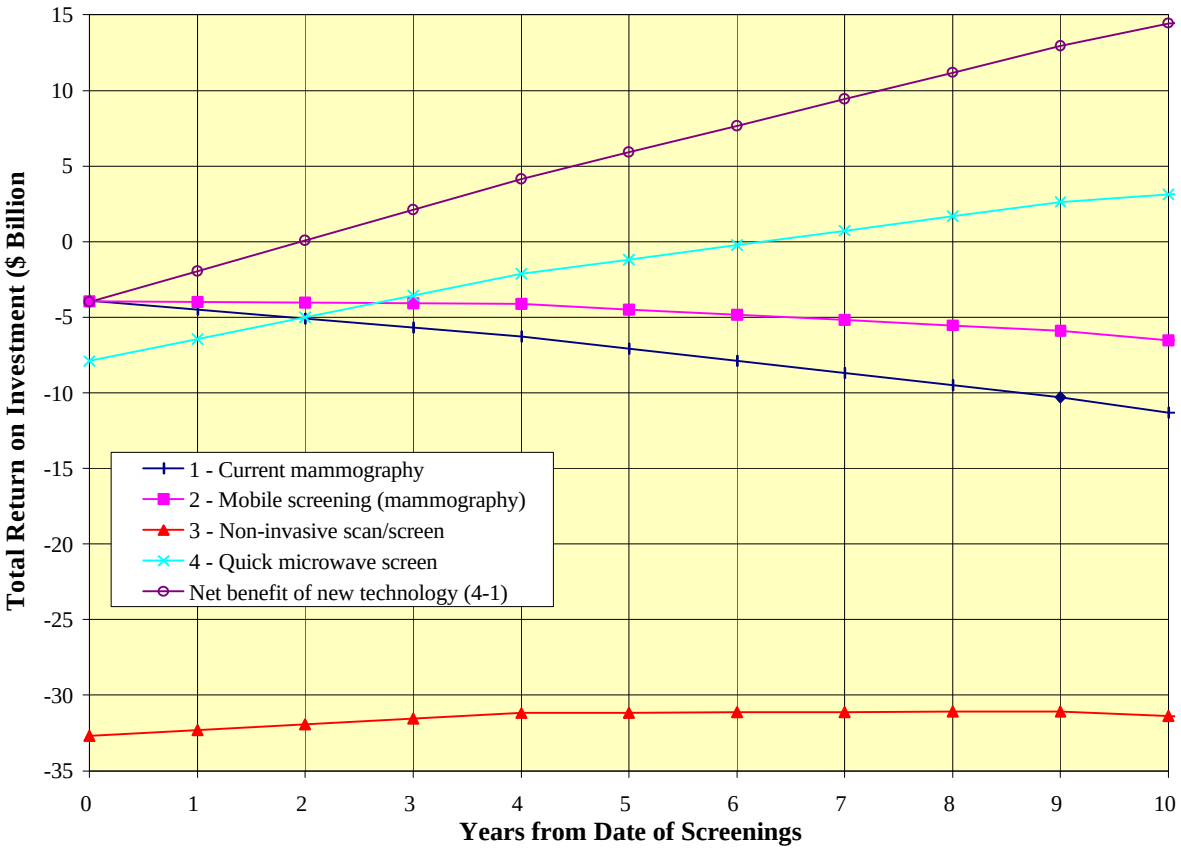
The significant difference seen between this calculation and the one without demographics is a result of the large fraction of those over 65 who do not return to work after successful treatment, which was not accounted for in the previous calculation.

It is likely that the application of accurate age demographics will reduce the net benefit for most or all conditions, since the incidence of disability and disease generally increases with increasing age. However, the net benefit of many new technologies is likely still positive, as shown in this breast cancer screening example.

This analysis admittedly does not account for all factors, and the magnitudes of the returns on investment and net benefit will fluctuate with changes in the input values. However, the overall positive fiscal impact on society of investment in new technology for breast cancer screening is clearly illustrated here.

The 10 year returns on investment and net benefit of investment in new technology have been calculated for most of the D/D cards in the same manner as shown above for the breast cancer screening example. These results are given in Table 3, which also includes the estimated frequencies of occurrence and

Figure 6. Returns on Investment from Breast Cancer Screening Alternatives. (13M screens, 169K cancers in one year; true age demographics)



assumed ages of patients. In general, options 2 through 4 are new technology options, although in some cases, option 2 is a current treatment option. The D/D cards in Appendix F contain the specific treatment options.

Many observations follow from Table 3:

- The net benefits are all positive with two exceptions (D/D card 24 and DD 15 with an assumed age of 68)) and range from near zero to hundreds of billions of dollars for the set of input values used here.
- For those conditions that are primarily associated with the elderly or with babies (D/D cards 12, 13, 15, 20, 24, 32), most treatment options have negative returns on investment. However, the **net** benefits can be positive in that new technologies can reduce the fiscal drain on society associated with current treatment options.
- For some conditions, such as diffuse atherosclerosis (D/D card 2), current treatments have negative returns on investment. Future technology-based treatments hold promise to provide positive returns.
- The point in time at which the net benefit becomes positive is different for each condition, and occurs anywhere from several months to many years after the technology is developed and used.

Table 3. 10 Year Return on Investment (ROI) in Dollars (Billions) for One Year's Patient

D/D Card	Description	Annual Frequency	Assumed Age	Option 1	Option 2	Option 3	Option 4	Option 5	Net Benefit[A]
1	Adverse Drug Reaction	20,000	55	3.5	5.0	5.2	**5.3**		1.8
2	Diffuse Atherosclerosis	500,000	45	-5.8	-39.0	31.9	53.4	87.2	92.9
3	Massive Battlefield Injuries	10,000	25	-0.01	0.02	1.1	1.4		1.4
4	Knee Osteoarthritis	100,000	50	-2.5	9.5	**20.4**			22.9
5	Blindness	10,000	25	-0.75	-0.6	0.12	0.37		1.1
6	Breast Cancer Screening	13,000,000[B]	50	1.2	**11.2**	-10.7	**31.9**		30.8
			distribution[C]	-11.3	-6.5	-31.8	3.1		14.4
7	Cancer Screening Interpretation[D]								
8	Colon Cancer Screening	6,000,000[B]	50	6.4	19.6	**27.9**			21.5
9	Heart Replacement	10,000	35	-0.3	**0.18**	0.9	**1.5**		1.8
10	Diabetes Mellitus	500,000	20	44.0	56.0	98.2	**114.6**		70.6
			distribution[C]	-8.7	-4.3	16.9	20.7		29.3
11	Hearing Loss	10,000	20	0.5	0.18	1.4			0.9
12	Hip Fracture	300,000	70	-40.5	-28.3	-36.1			12.2
13	Home Bound Patient	1,500,000	65	-172.5	-142.5	**-123.0**	**-112.5**		60.0
14	Ischemic Heart Disease Diag.[E]	2,100,000							
15	Ischemic Heart Disease Treat.	1,000,000	55	0.5	47.0	108.9	181.7		181.2
			68	-31.3	-76.0	-112.6	-88.3		-57.0
			distribution[C]	-21.7	-43.4	-57.4	-20.8		0.9
16	Kidney Failure	120,000	30	-12.6	-14.0	-15.9	15.3		27.9
17	Liver Replacement	10,000	45	-0.99	-2.4	0.3	**0.25**		1.3
18	Lung Cancer	200,000	50	-8.2	**16.8**	50.9			59.1
19	Lung Replacement	10,000	30	-1.7	-0.85	0.26	0.022		2.0
20	Medication Compl/Monitor	10,000,000	80	-600.0	-575.0	-475.0	**-335.1**		264.9
21	New Information Dissemination[F]								
22	New Procedure Adoption[G]	1,000		0.036	0.014	0.092	**0.16**		0.13
23	Paraplegia	3,000	20	-0.16	-0.34	-0.083			0.08
24	Premature Birth[H]	8,000	35	-1.4	-2.4	-1.8	-2.7		-0.45
25	Prostate Cancer Screening	6,000,000[B]	50	4.6	**12.8**	14.6	**24.0**		19.5
26	Quadriplegia	3,000	25	-0.65	-0.74	-0.22			0.44
27	Skin Cancer Screening	1,000,000[B]	50	9.2	9.3	9.6			0.4
28	Tissue Diagnosis[D]	1,700,000							
29	Unknown Critical Info	200,000	45	9.4	35.9	**42.1**			32.7
30	Disaster Evaluation/Triage	10,000	25	0.33	0.97	1.3	1.4		1.1
31	Severe Burn Victim	10,000	35	-0.93	-0.26	0.08			1.0
32	Threatened Early Delivery[H]	100,000	25	-6.0	-5.4	-5.8	-5.5		0.6

[A] Net benefit = Difference between maximum of options 2-5 and option 1
[B] Cancer screening ROI values based on cost of given number of screens and return to productivity for 169K (breast), 157K (colon), 125K (prostate), and 35K (skin) cancers.
[C] True age demographics used in calculation, see Figure 5 for distributions
[D] Interpretation and tissue work considered as part of cancer screening for ROI calculation.
[E] Diagnosis considered as part of heart disease treatment for ROI calculation
[F] Positive benefit expected with increases in communication technology
[G] ROI and net benefits assume one new procedure and 1000 cases using that procedure
[H] ROI calculated for the baby, not the mother
Bold options were successfully developed during the game **underlined** options were used by patients
Shaded lines show the effect of true age distributions on ROI

- Analyses such as this can provide strong guidance for setting R&D priorities. Some technologies only promise returns in the millions of dollars due to low frequency of occurrence or some other reason, while others may have returns of many billions of dollars.
- Investment in technologies primarily associated with the elderly promise a high rate of return, as evidenced by the $60 and $264 billions of dollars of benefit shown for D/D cards 13 and 20, respectively.
- Investment in new diagnostics and treatments for cancer also show great promise for large returns (D/D cards 6, 8, 18, 25, 27).

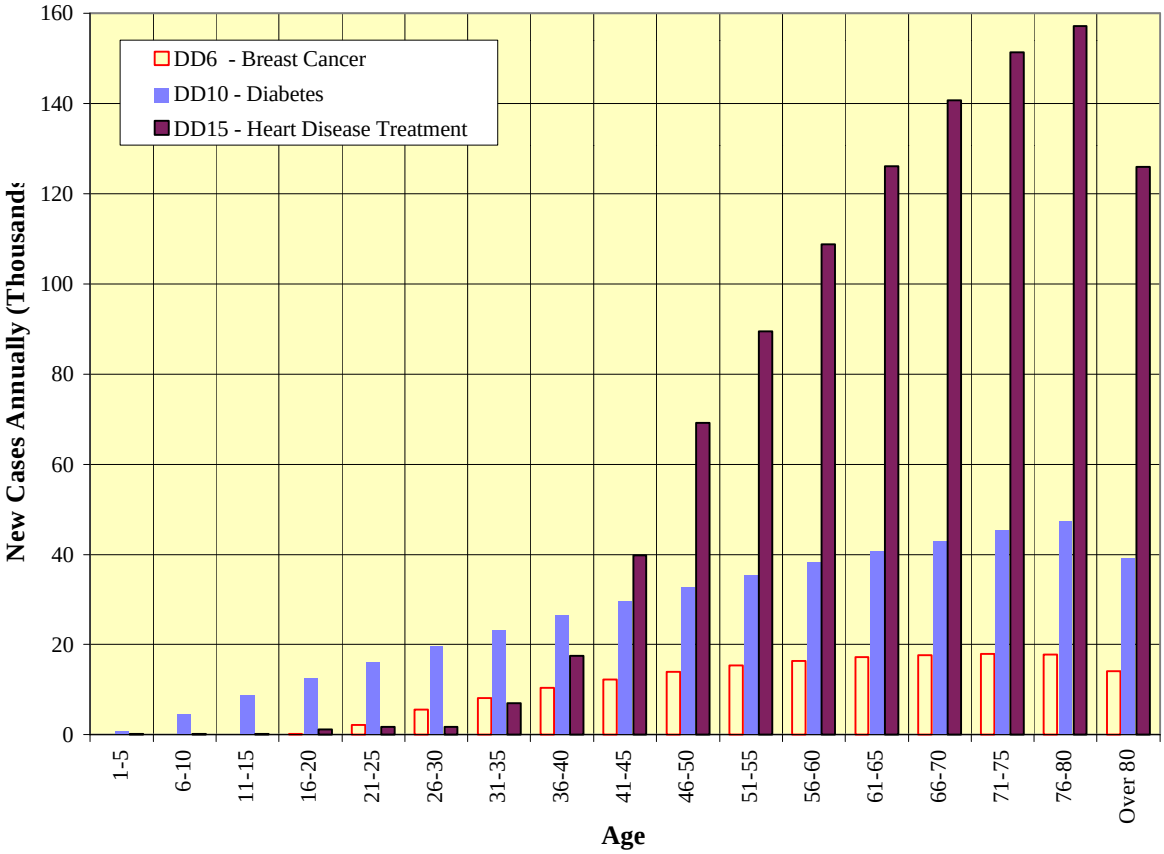
The effect of using true age demographics has been calculated for two D/D cards in addition to the previous calculation shown for breast cancer screening. These cards are highlighted by shading in Table 3. The age distributions for the three calculations are shown in Figure 7, and were derived in the same manner as shown previously in Figure 5. For heart disease, the treatment was assumed to have a distribution that scaled to that of diagnosis, for which data were available. Table 3 shows that for diabetes mellitus (D/D card 10), as for breast cancer screening, the first two treatment options show negative returns on investment when the correct age information is used. Options 3 and 4 show positive returns, and the resulting net benefit, while still strongly positive ($29B) is 60% less than that calculated using a constant age assumption. For ischemic heart disease treatment (D/D card 15) the difference is even more striking. When the correct age distribution is used, all treatment options have negative returns, and the net benefit is only $0.9B. Furthermore, if a constant age of 68 is assumed rather than a constant age of 55, the net benefit is highly negative.

The effect of using the correct age distribution was to reduce the net benefit by 53%, 58%, and 99%, for breast cancer screening, diabetes mellitus, and ischemic heart disease treatment, respectively. The difference in the amount of reduction reflects differences in the age distributions of the three conditions. The average ages for the three conditions are 61, 57, and 68, respectively. The reason for the increase from 53% reduction to 99% reduction with an average age that moved from pre- to post-retirement is clear. However, it is interesting that diabetes mellitus had the lowest average age, and yet a higher reduction than did breast cancer screening. The reason for this is that, as shown in Figure 7, the distribution for diabetes mellitus includes many youths under the age of 20. For purposes of calculating productivity, patients under 20 were assumed to have the same productivity as those over 65. These three calculations provide some indication as to how much reduction in net benefit will be seen for other conditions when the true age demographics are factored in.

Table 3 also shows the new technology options that were successfully invested in, developed, and made available as treatments during the game. These are indicated in **bold** type. Those newly implemented options that were used by patients in the game are **underlined**, along with their net benefits. In addition, the new technology option for D/D card 20 was available for use, but was overlooked by the doctor and patient who had a chance to use it. It is likely that this was just oversight and not keeping up with the progress of the game, rather than a matter of choice.

The sources for frequency of occurrence data are given in Table 4. In those cases where estimates were made with no supporting data, a minimum of 10,000 cases per year was used. Even when the true number of cases might be less than this, with advanced technology the

Figure 7. Distribution of Condition as a Function of Age.



frequency might increase due to the availability of good treatment options.

To this point, we have only calculated returns on investment for one year's group of patients. For most of the conditions examined in this game, new diagnoses are an annual occurrence, and thus any benefits for one year's group of patients can be increased as the new treatment is used for more years. The effects of multiple years' patients can be calculated by summing the results of the ROI equation as follows:

$$ROI(total, t=n) = ROI(t=1)+\ldots+ROI(t=n).$$

The technology development cost given as the third term in the original ROI equation should only be included once, although it is typically small compared to the productivity term.

The results of this calculation for the breast cancer screening example are shown in Figure 8. This shows many of the features of the one year plot of Figure 6, with the exception that a positive return on investment is not seen for any treatment alternative during the 10 years. This is due to the cost of treatment coming up front and then having the benefits accrue over years into the future. This calculation includes 10 years worth of treatment costs, but only a fraction of the return on investment that will result from the treatments. Nonetheless, the net benefit is positive at $67B after the 10 year period.

Table 4. Sources for Frequency of Occurrence Data.

D/D Card	Description	Annual Deaths[A]	Annual Frequency	Sources
1	Adverse Drug Reaction		20,000	Estimate 400 deaths annually[B]; 0.02 death rate[C]
2	Diffuse Atherosclerosis	17,000	500,000	Data[D]
3	Massive Battlefield Injuries		10,000	Estimate[C]
4	Knee Osteoarthritis		100,000	Estimate[C]
5	Blindness		10,000	450K legally blind in US[E]; assume over 45 years
6	Breast Cancer Screening	44,500	13,000,000	40M females 50+, 30% mammograms annually[F]
7	Cancer Screening Interpretation			
8	Colon Cancer Screening	58,000	6,000,000	Assume screen frequency half of breast cancer
9	Heart Replacement		10,000	2340 transplants in 1994[G]
10	Diabetes Mellitus	56,000	500,000	Data[D]
11	Hearing Loss		10,000	Estimate[C]
12	Hip Fracture		300,000	Data, 90% in elderly[D]
13	Home Bound Patient		1,500,000	1.4M home health visits daily in US, 75% elderly[F]
14	Ischemic Heart Disease Diagnosis		2,100,000	Data, includes myocardial infarction[D]
15	Ischemic Heart Disease Treat.	480,000	1,000,000	700K angioplasties/bypasses in 1992 ??
16	Kidney Failure	23,000	120,000	Estimate 0.2 death rate[C]
17	Liver Replacement	26,000	10,000	3650 transplants in 1994[G]
18	Lung Cancer	150,000	200,000	Data[D]
19	Lung Replacement		10,000	740 lung, 70 heart-lung transplants in 1994[G]
20	Medication Compl/Monitor		10,000,000	24M 65-79 (assume 1/3 need), 8M 80+ (all need)
21	New Information Dissemination			
22	New Procedure Adoption		1,000	Estimate, 1 procedure, 1000 cases to show trend
23	Paraplegia		3,000	Estimate 100K in US[H]; assume over 30 years
24	Premature Birth	4,000	8,000	Estimate 0.5 death rate[I]
25	Prostate Cancer Screening	36,000	6,000,000	Assume screen frequency similar to colon cancer
26	Quadriplegia		3,000	Estimate 100K in US[H]; assume over 30 years
27	Skin Cancer Screening	7,000	1,000,000	Estimate[C]
28	Tissue Diagnosis		1,700,000	870K benign neoplasms yearly[D] plus new cancers
29	Unknown Critical Info	40,000	200,000	Symptoms, signs, ill-defined[D]; 0.2 death rate[C]
30	Disaster Evaluation/Triage		10,000	Estimate[C]
31	Severe Burn Victim		10,000	Estimate[I]
32	Threatened Early Delivery		100,000	Estimate 2.5% of livebirths[I]

[A] National Center for Health Statistics. **Births, marriages, divorces, and deaths for March 1995. Monthly Vital Statistics Report**, vol. 44 no. 3. Hyattsville, MD: Public Health Service. 1995.

[B] Albuquerque Journal, October 1995.

[C] Dr. Fidel Davila, Scott and White Clinic, Temple, TX 76508

[D] National Center for Health Statistics. **National Hospital Discharge Survey: Annual Summary, 1993**. Vital Health Stat 13(121). 1995.

[E] Encarta

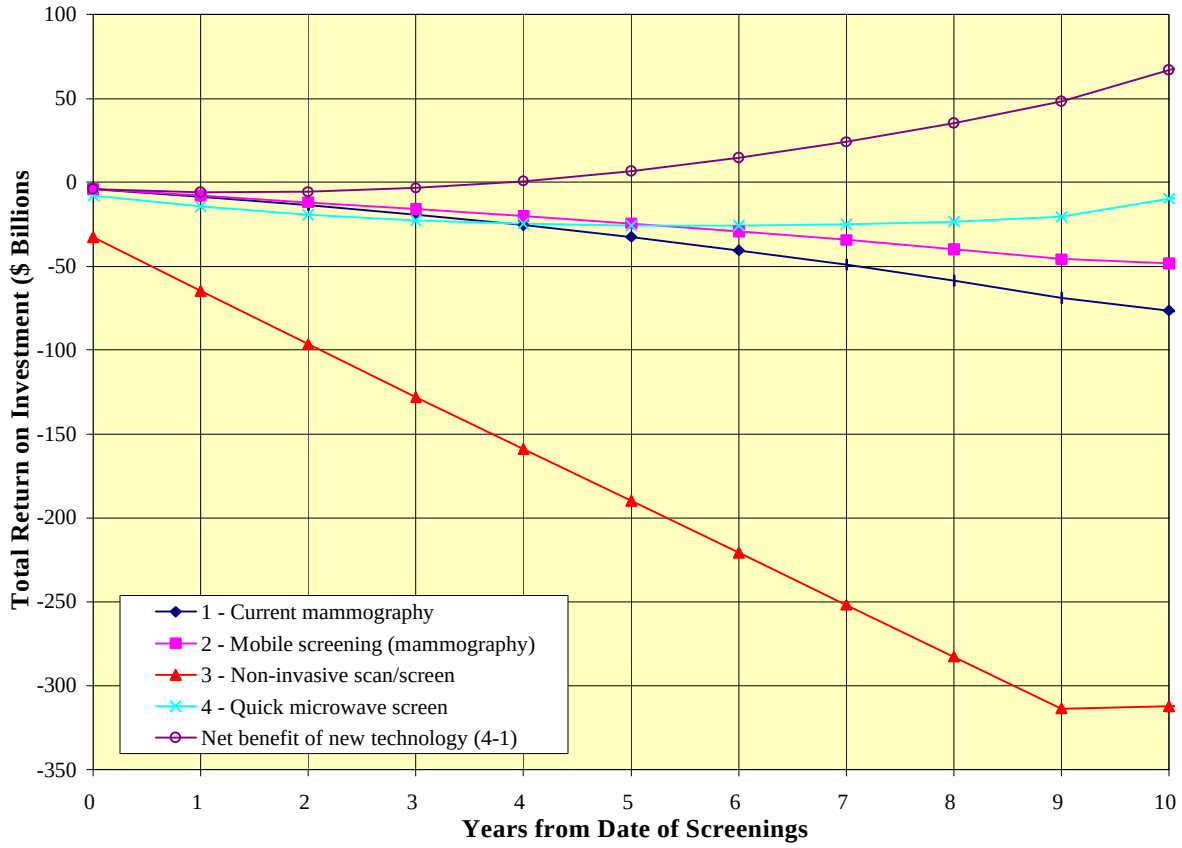
[F] National Center for Health Statistics. **Health, United States, 1994**. Hyattsville, MD: Public Health Service. 1995.

[G] UNOS Scientific Registry. Available at http://www.infi.net/~shreorg/stat/stat_tran.html.

[H] 20/20 News Magazine, Barbara Walters interview with Christopher Reeve, August 1995.

[I] Game designers

Figure 8. Returns on Investment from Breast Cancer Screening Alternatives. (13M screens/year and 169K cancers/year for each of 10 years; true age demographics)



The calculations detailed in this section show in general that investment in technology solutions to medical challenges will result in treatment options that will have strong positive returns to society. The returns on investment are estimated to be in the billions of dollars per year for such investments, while it is estimated that the development costs are only in the hundreds of millions of dollars for many of the promising technologies. Additional benefits not addressed in this game could accrue from the reduction in medical personnel required to deliver health care. For example, curing a paraplegic or quadriplegic could free up to seven people who are currently needed to provide assistance; home health monitoring also reduces the medical personnel required to deliver care.

The development of a systems approach to prioritizing health care technology investments (similar to our simple approach, but with improved data and algorithms) would provide both guidance and metrics for maximizing the return on investment. The potential returns are well worth the investment.

Health Care Quality

The specific objectives of this Prosperity Game were to address technology solutions to not only cost, but also quality issues. Quality of care and quality of life are very difficult to measure directly, and must often be inferred from survey data. We have conducted such a survey in conjunction with the D/D cards.

Quality surveys were printed on the back of each D/D card with the seven questions shown in Table 5. Both the patient and care provider were asked to independently answer these questions regarding the treatment given in response to the specific disease or disability. Responses were based on the following scale: 1 = very bad, 2 = bad, 3 = neutral, 4 = good, and 5 = very good.

The mean responses for patients and doctors for each of the two Provider teams to the seven questions are given in Table 5. The full set of responses for each patient and doctor are given in Appendix G. The table also contains the mean treatment and outcome ranks for each group of patients. Treatment rank is defined as the option number of the treatment from the D/D card. Option 1 was always a current treatment option, while options 2-4 were typically future treatments based on undeveloped technology. Option number generally increased with increasing probability of good outcomes. Outcome rank corresponds to the four specific outcomes supplied on the D/D card for each treatment option. In most cases the four outcomes were death, poor, partial recovery, and complete recovery. These four outcomes were ranked from worst to best as 1 to 4, respectively.

The data in Table 5 give rise to many observations. All mean responses are greater than 3.0, which indicates that quality of care and the resulting quality of life are generally positive. It is noteworthy that the lowest responses are for the adequacy of technology and resulting quality of life. Neither patients nor providers had as much concern about cost, efficiency of care, or its appropriateness, as they did about the availability of technology and the way it could increase quality of life.

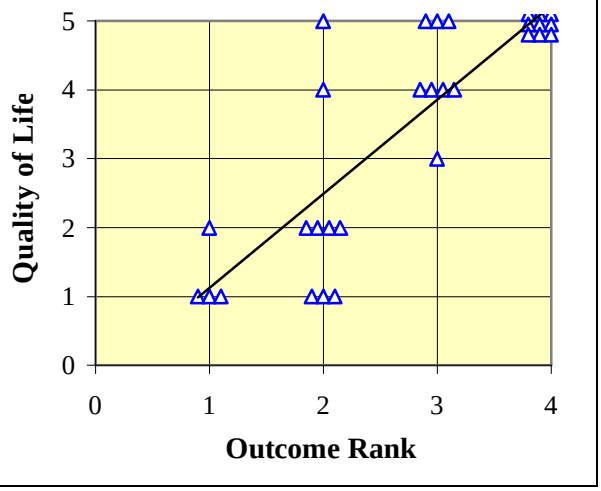
There are many differences in the points of view of patients and providers as follows:

- Doctors from both Provider teams felt that the treatments they gave were much more appropriate than did the patients. The differences are statistically significant to greater than 95% confidence.
- Doctors felt that the prescribed treatments minimized risk much more than did the patients to greater than 90% confidence.
- Doctors felt that the technology was adequate more than did the patients.
- Doctors were also more satisfied with the overall process and outcomes than were

Table 5. Mean Quality of Care Responses From Patients and Doctors.

Question or Metric	Provider 1 (Indep.) Patient	Provider 1 (Indep.) Doctor	Provider 2 (HMO) Patient	Provider 2 (HMO) Doctor
Treatment rank (option # from D/D card)	2.29		2.13	
Outcome rank (1=worst, 4=best)	2.64		2.81	
1. Cost was reasonable?	3.93	3.93	3.88	3.81
2. Treatment was efficient?	3.86	3.79	3.63	3.69
3. Treatment was appropriate?	3.86	4.50	3.94	4.50
4. Treatment option minimized risk?	3.43	4.00	3.69	4.07
5. Was technology adequate?	3.29	3.71	3.25	3.50
6. Did the treatment improve your quality of life?	3.36	3.91	3.56	3.20
7. Overall satisfaction:	3.64	3.86	3.50	3.75

Figure 9. Quality of Life as a Function of Outcome Rank for All Patients.



the patients.

- Provider 1 (independent) doctors felt that their treatments improved the patients' quality of life more than did the patients. By contrast, Provider 2 (HMO) doctors felt that their treatments improved the patients' quality of life less than did the patients.

The responses to the seven questions were correlated to both treatment rank and outcome rank to better understand the data. Nearly all responses showed increases with increases in treatment rank and outcome rank. The only two exceptions to this were the slightly negative slope for minimizing risk and outcome rank for the Provider 2 doctors, and the lack of correlation between the appropriateness of treatment and treatment rank for Provider 1 doctors. This lack of correlation coupled with the high mean response to the question (4.5 out of 5) indicates that these doctors felt that they were always prescribing the appropriate treatment.

One would a priori expect quality of life to correlate strongly with outcome rank, since good health is a well-recognized component of quality of life. The data for all patients substantiate that assumption as shown in Figure 9. Given that the probabilities of the higher outcome ranks increase with increasing technology (an assumption built into the D/D cards), this implies an increase in quality of life with increasing technology.

Another indication of the correlation between increased quality of life and increasing technology is shown in Figure 10. Here, quality of life is plotted against treatment rank. The data from patients obtaining treatment from both Provider teams show the same

Figure 10. Quality of Life as a Function of Treatment Rank.

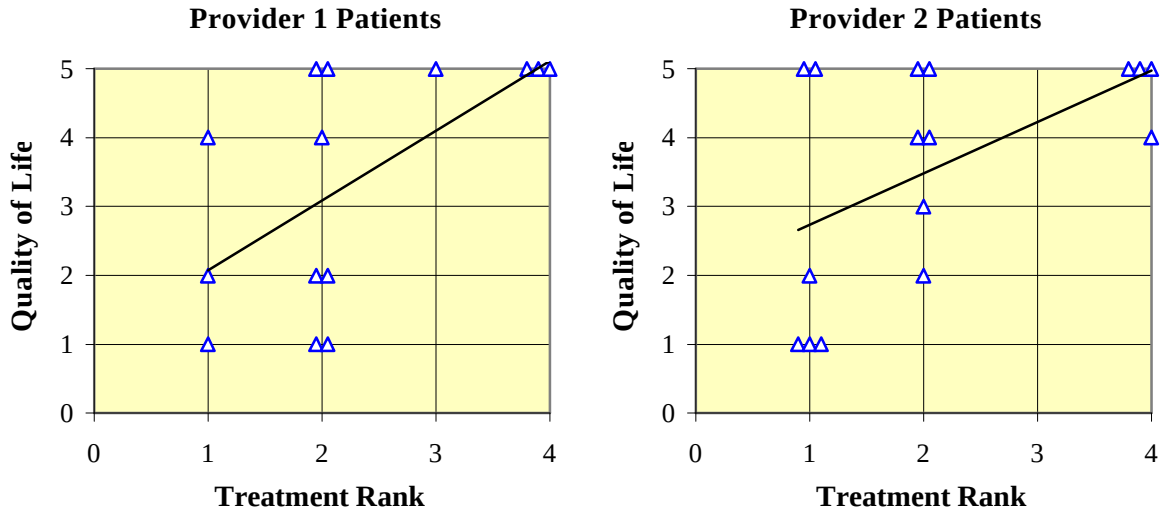
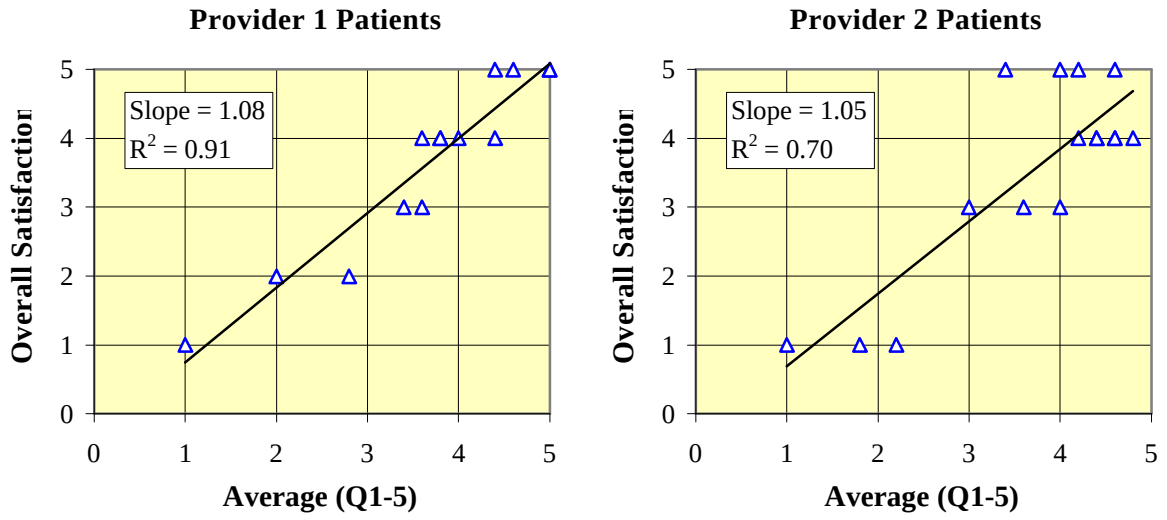


Figure 11. Overall Satisfaction as a Function of the Average Response to Questions 1-5.

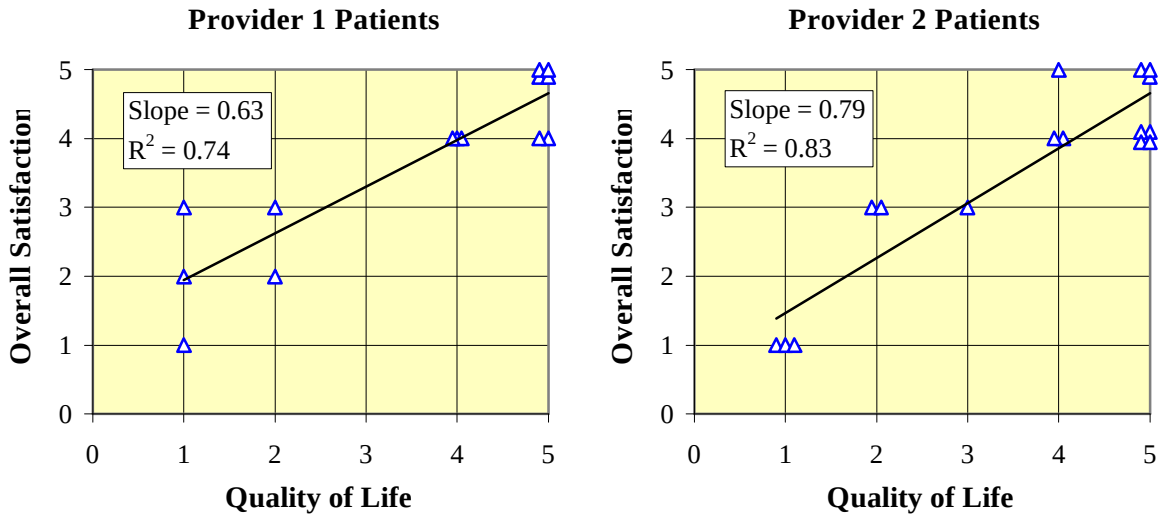


thing. For a low treatment rank, quality of life responses span the entire range from 1 to 5, while for the most advanced treatments, the quality of life responses are all either 4 or 5. These responses are just what should be expected. For a low treatment rank, outcomes span the range from death to full recovery; thus, given the correlation of quality of life with outcomes as shown in Figure 9, the quality of life responses should span the range. By contrast, for the most advanced treatments, the majority of the outcomes should be very good; thus, the quality of life responses should be in a narrow range at the high end. The effect of increasing technology is therefore to increase quality of life by reducing the probability of unacceptable outcomes.

Another question to resolve is whether a patient's overall satisfaction is related to quality of life or some other factor or set of factors. We hypothesized that a patient's overall satisfaction with the treatment process would be positively influenced by factors other than quality of life, namely the factors in the first five questions, those dealing with cost, efficiency, appropriateness, risk, and adequacy of technology. To check this, we compared the average response from the first five questions to overall satisfaction. The results are shown in Figure 11. The data show that overall satisfaction correlates strongly with the average response to questions 1-5. For each of the two sets of patients, the slope is nearly 1.0 with high correlation values, indicating that, on average, the values match nearly one to one.

Overall satisfaction also correlates well with quality of life, as shown in Figure 12. However, the slopes for the two sets of patients are significantly less than 1.0, and the data show that at lower qualities of life, patients are more satisfied with their care than quality of life alone would indicate. Thus, the data favor the hypothesis set forth that factors other than the resulting quality of life can positively influence a patient's overall satisfaction with the receiving of medical treatment.

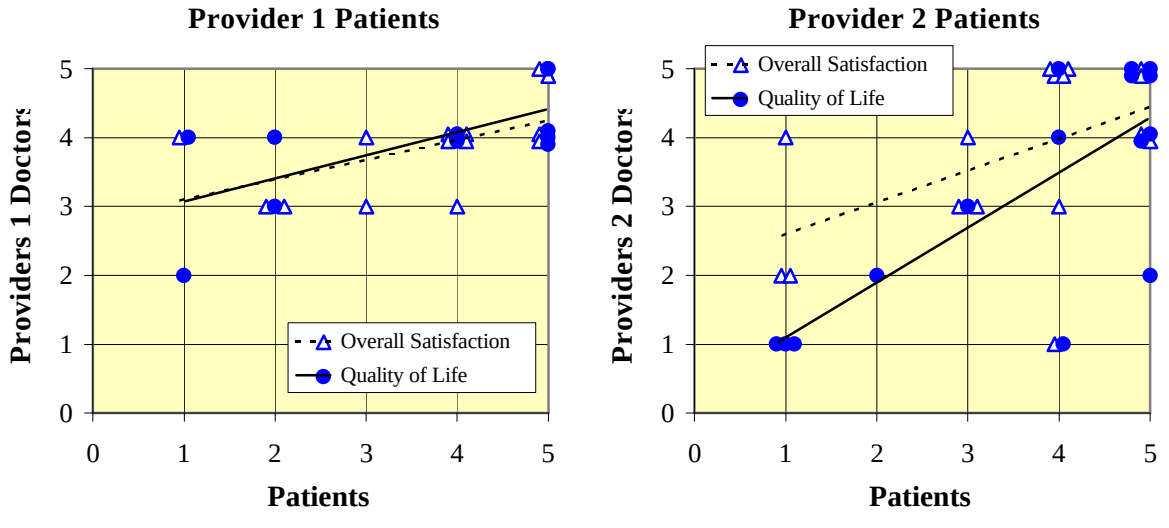
Figure 12. Overall Satisfaction as a Function of Quality of Life.



One point made earlier was that doctors were more satisfied overall with the process and outcomes than were the patients. More data on this point are shown in Figure 13. The Providers 1 (Independent) doctors' assessments of overall satisfaction and quality of life were much higher than those of the patients for low values and nearly the same for high values. The Provider 2 (HMO) doctors gave similar assessments for overall satisfaction, but matched the patients feelings on quality of life. The reason for the difference between the Provider 1 and 2 doctors' responses is not known.

The analyses here are based on small sample sizes. The trends and observations resulting from these data are very interesting, and may be either substantiated or refuted by larger studies. The authors suggest that great benefit in understanding quality of life and its surrounding issues in the health care field

Figure 13. Comparison of Patients and Doctors Responses on Overall Satisfaction and Quality of Life.



would result from well-conducted large studies of the issues presented here.

Team Highlights

Consumers

The team was initially confused over who they were. They were concerned about the uninsured "poor," presumably those who did not qualify for Medicaid or Medicare because they were not poor enough or old enough (since government insurance was a major component of the game).

The team's goals were to maximize health care at minimum cost, and to retain patient choice of providers and treatments. Strategies to accomplish these included an increased emphasis on self-care and prevention, education, information about treatments and outcomes, flexibility of insurance designs, and political action.

Lessons learned included: money dominates everything; the role of technology is swamped by other factors (financial, social, political); patients have little control over health care costs; more money spent on administration than on developing new technologies. The team had a strong desire for self care and home care, and invested in information technologies.

Providers 1 - Independents

Although ostensibly "independent," the team decided to form an Independent Multi-specialty Group, to "obtain clout and work together effectively," both in the game and in real life. They wanted to have control of both clinical and business decisions and still have access to the capitation dollar through agreements with Insurers and HMOs.

The team focused on three issues: 1) Linking independent physicians into effective care delivery units; 2) Maintaining quality of care; and 3) Increasing efficiency. Their challenges were to:

- Maximize information systems
- Use technology to avoid waste
- Maximize home care
- Differentiate themselves
- Avoid anti-trust concerns by preserving choice
- Get relief from the need for insurance reserves.

Over the course of the game, the team developed a new model for Independent Physicians:

- Organized as a confederation of independent practices
- Linked by an effective information system
- Granted local control over negotiating capitation rates with patients to preserve choice and avoid anti-trust regulations
- Organized politically for anti-trust protection and relief from requirements to keep large cash reserves
- Granted local control on clinical decisions
- Differentiated from HMOs by establishing personal physician-patient relationships
- Differentiated from HMOs by being first to adopt new technologies through alliances with suppliers and regulators
- Assumed both risks and profits as an entrepreneurial health care business
- Outsourced administration of insurance premiums for 10% of premium dollar.

The Independent Providers team considered themselves highly successful and innovative, and the facilitator and analyst concurred.

Providers 2 - HMOs

The HMO set three goals: 1) Keep everyone healthy; 2) Provide appropriate and responsive care; and 3) Maximize market share. They felt that they accomplished all three goals in the game.

Early in the game, the team signed a contract with the Insurers that proved disastrous. They finally decided to bypass the Insurers and go directly to the Consumers; they offered lower costs, faster treatments, and less bureaucracy.

Despite the advantages (better patient outcomes and lower treatment costs) of improved technologies explicitly provided in the D/D cards, the HMO team did not believe that buying technology would pay off in the long run. This was a result of the contract which gave the Insurers the treatment income but only provided the HMO with a monthly stipend.

The team concluded that new technology was not the dominant issue, but rather how to use existing technology better. They felt that technology needs to be driven by end-users and customers' needs. They also realized the need for legal advice before signing contracts.

Insurers

Despite significant modifications to their role and instructions, the Insurers had major difficulties similar to those that occurred in the Prototype. They felt that they lacked "heavy duty insurance expertise." *(Two players from Kaiser Permanente and Baxter Healthcare did not show up.)* Their decision to operate as a single insurance association (rather than separate into private and government insurers) caused problems in the game which eventually led to a lawsuit.

The team adopted a simple two-pronged mission: Promote health and provide value. Their goals included: universal access to health care; developing benchmarks for quality and cost-effectiveness; develop health care products; be brokers for provider and patient information; lead in ethics and privacy; and be advocates for their patient customers. They sought to establish centers of excellence with the help of telemedicine; provide choice; make alliances with providers; reduce costs; and seek healthy, high-profit customers.

Because of the difficulties the team encountered in the game, they felt that the game did not understand insurers, that the insurance industry was more complex than modeled, and that the litigation that occurred was disruptive (like real life?).

Legislators

The team's goal was to "Maximize present value of health care benefits per dollar invested, through the government process." They passed enabling laws early on to reduce barriers and encourage market development. They believed that they created a workable governing process, assigned priorities, streamlined the FDA process, enabled more competitive physician models, and made long-term investments supporting prevention, education and a date base information system.

The legislators felt that the system worked to benefit all stakeholders when they provided the right incentives.

Suppliers/Manufacturers

The team's goal was to "Improve health care delivery and save lives while making a profit." An intra-team consortium was formed. They sought to gather market intelligence to determine their technology investments, form relationships with universities and labs to leverage funds, and form relationships with providers to work on policy.

Several product lines were developed: home healthcare, cell-cultured replacement organs, an RF cancer treatment, biogenetic markers, and an alliance for standards and data transfer.

The team felt that they needed more feedback on the outcomes of their investments and negotiations. They also objected to the fact

that the Universities/Labs team were bringing products to market.

FDA/Regulators

The FDA team expressed a desire to work with the other groups to facilitate the approval process. They identified four key areas to work: risk vs. benefit, collaborations, the regulatory process, and information. Their goals were to protect public health and ensure safety and effectiveness of medical devices.

The team used the Internet to collect adverse effects data, and to get the public and doctors to accept higher risks with new technologies. They decreased the regulatory approval process time by 75%. They collaborated with universities/labs, suppliers, providers and insurers on rapid prototyping.

Planning/Funding

The team was hampered throughout much of the game as a result of strongly differing views on telemedicine. Some members felt the game was biased towards certain technologies and the players were too "homogeneous." [*Ed. The game was not intentionally biased in any direction, and only about 20% of the invitees actually played.*]

The team's goals included: Increasing available funds and identifying technologies to improve access to health care, improve health status, improve quality, and reduce costs. They focused on the size of the population served by the technology, common diseases with known treatments, early detection, and needs that were not being met elsewhere.

Universities/Labs

The team had two goals: Define pathways to increase funding for biomedical research, and; Identify technologies that can improve quality of care, quality of life, improved accessibility for underserved patients that reduces costs.

One accomplishment was the creation of a Strategic Health Care Office for building a coordinated national program for biomedical R&D. They also identified technology areas that needed increased R&D investment. The team achieved a greater understanding of the complexity of the medical problem from different perspectives.

They learned that the key need was to develop a national focus and a coordinated approach, together with team building and alliances.

Lawyers

The team's mission was "To facilitate the games, with a focus on high-tech health care, and to settle disputes quickly to enable advances in, and to lower the costs of health care delivery systems.

They believed that the other teams would need sound legal advice early, but, as in real life, their value would not be recognized until some initial mistakes were made. As expected, their initial attempts to join the other teams as legal counsel were not successful.

They identified their top concerns: 1) Which state jurisdictions should be federal (privacy, licenses to practice medicine, product regulation)? 2) FDA approval issues (too broad, too slow, allow patients to voluntarily participate in experimental procedures). 3) Product liability issues (who works in telemedicine, public perception that technology is infallible, malpractice boundaries).

The lawyers expectations were realized in the game. Patent disputes began. An antitrust case arose over the HMO-like behavior of the Independent Providers. The insurers precluded choice by offering only a single policy option.

The team felt they were successful in lobbying the legislature, obtaining intellectual property rights, representing their clients, educating the

providers, and extricating their clients from their legal difficulties.

Toolkit Investments

The players were initially provided with 59 possible technology investments from the Toolkit (see Appendix H). They chose to make investments in 16 of these during the Toolkit investment period, of which 11 passed, as shown in Appendix H. After this period, they returned to re-invest in two options that had previously failed, and four more that had not received any previous investments. Hence, by the end of the day, they had successfully implemented 17 out of 20 Toolkit options. In addition, they created ten new options, all of which were eventually passed.

Of the ten original policy options in the Toolkit, six received investments and two passed. The players created two new policies, both of which passed (see Appendix H).

All the Toolkit Options and conventional investments that received funds are listed in Table 6. Health Informatics and Outcomes Research Tools were important to the players, and drew significant investments. Only computer-guided energy delivery systems were important for Minimally Invasive Therapies. However, a modified version of T10 was pursued twice, since it failed the first time.

Advanced Diagnostics and Telemedicine were also important areas of interest and investment. Energy Delivery Devices only addressed a laser device for removing atherosclerotic lesions. Assistive Technologies were important.

Internal Organ-Related Technologies drew investments in excess of $1.5 billion, the largest of any category based on dollars invested. The second largest dollar investment was in Outcomes Research Tools, at $1.32 billion. In third place was Advanced Diagnostics with $557 million.

Total investments in policies was relatively small at $200 million. The largest single investment was directed toward establishing private savings accounts for health care, similar to the current IRA model. Many other policy investments seemed aimed at improving the FDA regulatory process.

Perhaps the most surprising result was the huge desire of the players to obtain information and make it readily available to both patients and doctors. There were ten information- and outcomes-related investments including T1,T4,T7,T8, and N1,N2,N3,N4,N9, N10, for a total investment of $1.56 billion.

TABLE 6. PLAYER INVESTMENTS

	50% Inv $M	Inv $M	Ratio Pass/Fail
Health Informatics			
TOOLKIT			
T4 The 'Personal Health Information System (T2)' and 'Integrated Information Technology System (T3)' are developed and implemented simultaneously with full compatibility. (DD1; DD29)	110	194	1.76-P
T1 A secure local Internet-based health information system makes patient information accessible through wide area networks. (DD29)	90	20	0.22-F
CONVENTIONAL INVESTMENT PATH			
N1 Insurers and Universities/Labs form a joint venture to develop an end-to-end usability and user testing system for insurance-specific information communication.	1	2	2.00-P
N2 The National Labs/Universities and the Provider 1 teams develop a user facility test lab that will demonstrate the use of standards for medical information systems to achieve consensus on the design of a basic information infrastructure for tying together all the hospitals and clinics in the country. The lab will be established as a user facility at a National Lab, so that all vendors can use the system to evaluate their products.	10	20	2.00-P
N3 Make health information more available through easily accessible on-line services.	1	2	2.00-P
Outcomes Research Tools			
TOOLKIT			
T7 A widely accepted outcomes-based database is established and used as basis for medical treatment.	300	385	1.28-P
T8 A national electronic medical record and information system that allows new procedures to be scientifically analyzed and compared to current procedures (cost, quality) is brought on line. Uses existing computers (DD22)	80	85	1.06-P
CONVENTIONAL INVESTMENT PATH			
N9 (Joint with preventive measures) Increased availability, uniformity and use of outcomes information. More reliable information also.	150	250	1.67-P
N10 (Joint with preventive measures) Create a health system coordination technology to map needs and service delivery on a national basis; develop algorithms for identifying mismatches between needs and services and make recommendations for improving effectiveness.	250	600	2.40-P
Minimally Invasive Therapies			
CONVENTIONAL INVESTMENT PATH			
T10 MODIFIED Computer guided energy delivery system (including, but not limited to microwave, radio-frequency and focused ultrasound) capable of destroying tumors without seriously damaging adjacent tissues is developed at $1.5M per instrument and $7.5K per treatment. (DD18; other cancers)	200	500	2.50-P

Advanced Diagnostics

TOOLKIT

T17 Advanced image algorithms that screen chest radiographs, sputum cytologies, non-invasive scan images, video maps and biopsied tissue images to identify normals and abnormals are developed. (DD6; DD7; DD8; DD18; DD25; DD27; DD28)	60	47	0.78-F
T12 High-performance computing advances enable real-time processing and evaluation of 3-D medical images, and facilitates breakthroughs in computational biology and drug design.	50	10	0.20-P

CONVENTIONAL INVESTMENT PATH

T14 A portable, quick microwave screening technique that can be used to detect metabolically active cells that are suggestive of cancer is discovered and implemented at $150K per instrument and $150 per treatment. (DD6; DD8; DD25)	100	200	2.00-P
T17 Advanced image algorithms that screen chest radiographs, sputum cytologies, non-invasive scan images, video maps and biopsied tissue images to identify normals and abnormals are developed. (DD6; DD7; DD8; DD18; DD25; DD27; DD28)	60	90	1.50-P
N6 Discover genetic markers for breast, colon, lung, prostate cancers. Develop tests to effectively screen populations for these genetic markers. (Preventive also)	60	210	3.50-P

Telemedicine

TOOLKIT

T24 A secure system which allows the patient to regularly and urgently connect via a telemedicine link to a health provider (who may be out-of-state) to receive or arrange for health care is made available at $400 per system (DD13)	20	61	3.05-P
T21 A device that provides a physician virtual-reality sensing, first aid and triaging through a paramedic surrogate becomes available at $80K per device and $150 per use. (DD3; DD30)	80	30	0.38-F

CONVENTIONAL INVESTMENT PATH

N4 Computer system for home-based patients to access health care info, etc. through Internet. (Labs)	2	5	2.50-P
T25 A secure system which allows a home health provider to connect via virtual-reality-telemedicine link to perform testing, transmit physical exam findings and discuss with a physician is made available at $70K per system. (DD13)	40	60	1.50-P

Microelectronics and Sensors

TOOLKIT

T26 Vital signs monitors/transmitters become widely and inexpensively available at $200 per unit. (DD13)	30	55	1.83-P
T27 A vital signs and blood chemistry (O_2, hemo, cholesterol, cell counts) monitor becomes widely available at $250 per unit.	50	55	1.10-P

Energy Delivery Devices

TOOLKIT

T33 A laser device that removes (rather than fracturing or dilating) atherosclerotic lesions becomes available at $300K per instrument and $3K per treatment. (DD2; DD14)	80	20	0.25-F
Assistive Technologies for the Elderly/Disabled			
TOOLKIT			
T35 An artificial cartilage material that can be used to replace damaged cartilage and prevent osteoarthritis becomes available at $600 per treatment (DD4)	70	85	1.21-P
T42 A machine that dispenses correct medicines either orally or percutaneously per time with adjustments for VS becomes available at $3.5K. Tele-link alarm for missed doses or out-of-range VS. (DD20)	60	65	1.08-P
CONVENTIONAL INVESTMENT PATH			
N7,8 Improvements and accessories to improve safety and quality of life for motorized wheelchair users including high reliability, long life batteries, emergency communications, light weight life support, etc.	30	46	1.53-P
Internal-Organ-Related Technologies			
TOOLKIT			
T49 Tissue cultured and implantable human organs or replacement cells (heart, liver, pancreas, kidney) become available at $35K (DD9; DD10; DD17; lung, kidney replacement)	600	90	0.15-F
CONVENTIONAL INVESTMENT PATH			
T47 A human-compatible xenogeneic heart obtained from genetic engineering of a suitably sized animal becomes available at $20K. Life-long anti-rejection drugs may or may not be needed. (DD9)	300	600	2.00-P
T49 Tissue cultured and implantable human organs or replacement cells (heart, liver, pancreas, kidney) become available at $35K (DD9; DD10; DD17; lung, kidney replacement)	600	900	1.50-P
Preventive			
TOOLKIT			
T59 A system for patient education and behavior modification (diets, smoking cessation, exercise, etc.) becomes universally available	30	63	2.10-P
T57 Mobile cancer screening units become widely available for breast and colon cancer screens at the patients' locations. Costs are $500K per unit and $250 per screen. (DD6; DD8; DD25)	40	25	0.63-P
CONVENTIONAL INVESTMENT PATH			
N5 Risk analysis study to identify high risk groups (gunshot, traffic accident, etc.) that can be trained/educated/equipped such that risk goes down and hospitals incur fewer nonreimbursable costs. (Providers 1, Funders)	45	90	2.00-P

Policy Options

P1. The FDA reduces the time period for new technology testing by 50% by changing internal agency rules and procedures.	35	20	0.57-F
P2. Medical malpractice lawsuit punitive damage cap set to $1,000,000.	400	10	0.03-F
P6. FDA develops pilot program to work together with industry to reduce the time to bring new technologies to market by 75% (using FAA-like Boeing 777 "model").	70	10	0.14-F
P8. FDA implements a medical devices product development consultant accreditation process to reduce overhead time.	30	30	1.00-F
P9. Given that P8 passes, additional steps are implemented to reduce the FDA review and approval time by 75%. Note this does not affect clinical trial time.	30	30	1.00-P
P10. Congress establishes private savings accounts for health care along the current IRA model. Incentives are provided for private investments in biomedical technologies.	30	60	2.00-P

New Policy Options

P11. The federal legislature will fund/provide balanced meals and immunizations for needy children. Annual funding $20M from the health care budget and $80M from non-health care budget.	30	30	1.00-P
P12. Given that technology option 'T1 - Secure internet HC info system' passes, FDA will have access to all necessary information to investigate incidents and evaluate post-marketing surveillance information.	30	10	0.33-P

Health Care Issues and Solutions

One of the objectives of this Prosperity Game was to identify both technology and policy issues and proposed solutions to those issues. The beginning of a Biomedical Technology Roadmap was also an objective of this Prosperity Game. A keen understanding of the real issues affecting cost and quality in health care is essential to guide the development of such a roadmap.

Session 5 of this Prosperity Game was devoted to the identification of issues and solutions. Based on their life and game experiences to that point, each team was asked to identify the most important issues, problems, challenges, and potential solutions for employing technology and related policy in reducing costs and increasing quality. Each team was then to prioritize their issues. For each issue, the teams were asked to map their proposed solutions into the solution area spaces shown in Figure 14, or to propose new technology or policy solution areas. Figure 14 shows the issues template used in the game. All of the completed issue forms generated during the game (a total of 31) are reproduced in Appendix J.

Seven new technology and 7 new policy solution areas were proposed by the participants. For the purpose of constructing roadmaps in a few technology solutions areas, the many original and newly proposed areas have been combined into a new set of areas. These groupings are given in Table 7 along with the previous solution areas that were folded into the new areas.

Matrixes of the solution areas as a function of issue have been assembled and are provided in Appendix K. These matrixes have been composed using the new solution areas of Table 7. The purpose of these matrixes is to show several things including how important various solution areas are to each stakeholder group and which solution areas are globally connected to which groups of issues.

A measure of relative importance of the roadmapping areas has been determined based on the game results, and is shown in Figure 15. The figure shows three different intensity values for each solution area. The first is a measure of the sum of the number of Toolkit successes and number of contracts or agreements negotiated in each of the solution areas. As shown, preventive medicine had the largest number of contracts by a wide margin. Health informatics and assistive technologies were next with about half each as much as preventive medicine.

The second value is the number of issues for which each area was seen as contributing to the solution. Here, preventive medicine again had the highest intensity, and was seen as contributing to the solution of 21 issues. Close behind were health informatics, telemedicine, and information surety and security, with 20, 20, and 16 issues each. The third value is the sum of the first two.

Figure 14. Issues and Solutions Template.

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY			
Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):		Team: Issue Number: Relative Priority: (1=very low to 5=very high) Priority Ranking: (1=first, etc.)	
Possible Solutions:			
MAPPING INTO SOLUTION AREAS (Check all that apply)			
Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics		4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools		7	
8 Telemedicine		8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

Table 7. New Solution Areas.

Broad Roadmapping Areas:

1. Assistive Technologies
2. Health Informatics
   - Information System Incentives
   - Decision Support Systems
   - Data Mining
3. Information Surety and Security (technology and policy)
4. Microelectronics and Sensors
5. Minimally Invasive Therapies
6. Outcomes Research Tools
7. Preventive Medicine
   - Advanced or Non-invasive Diagnostics
   - Energy Delivery Devices
   - Public and Environmental Health
   - Medical Genetics
   - Government Incentive Programs
   - Industry and Public Educational Outreach
8. Telemedicine

Other Policy Areas:

1. Legislative/Regulatory Reform or Improvement
2. Tort Liability Reform
   - Liability
3. Metrics and Systems for Cost and Quality
   - Honest Broker or Clearinghouse
   - Electronic Billing Requirement
   - Data Collection, Management, Assessment
   - Risk / Benefit Analysis
   - Accreditation
4. Funding Allocation Systems

Thus, the game results indicate that preventive medicine has perhaps the highest relative importance of any biomedical technology area. The interrelated areas of health informatics, telemedicine, and information surety and security are perceived also as being of high importance.

Additional analysis was done to identify relationships between broad issue categories and solution areas. To perform this analysis, one-word descriptors were assigned to each issue. The issues were then grouped by their one-word descriptors, and the resulting matrix of solution areas was checked for correlations.

A list of the issues by category follows:

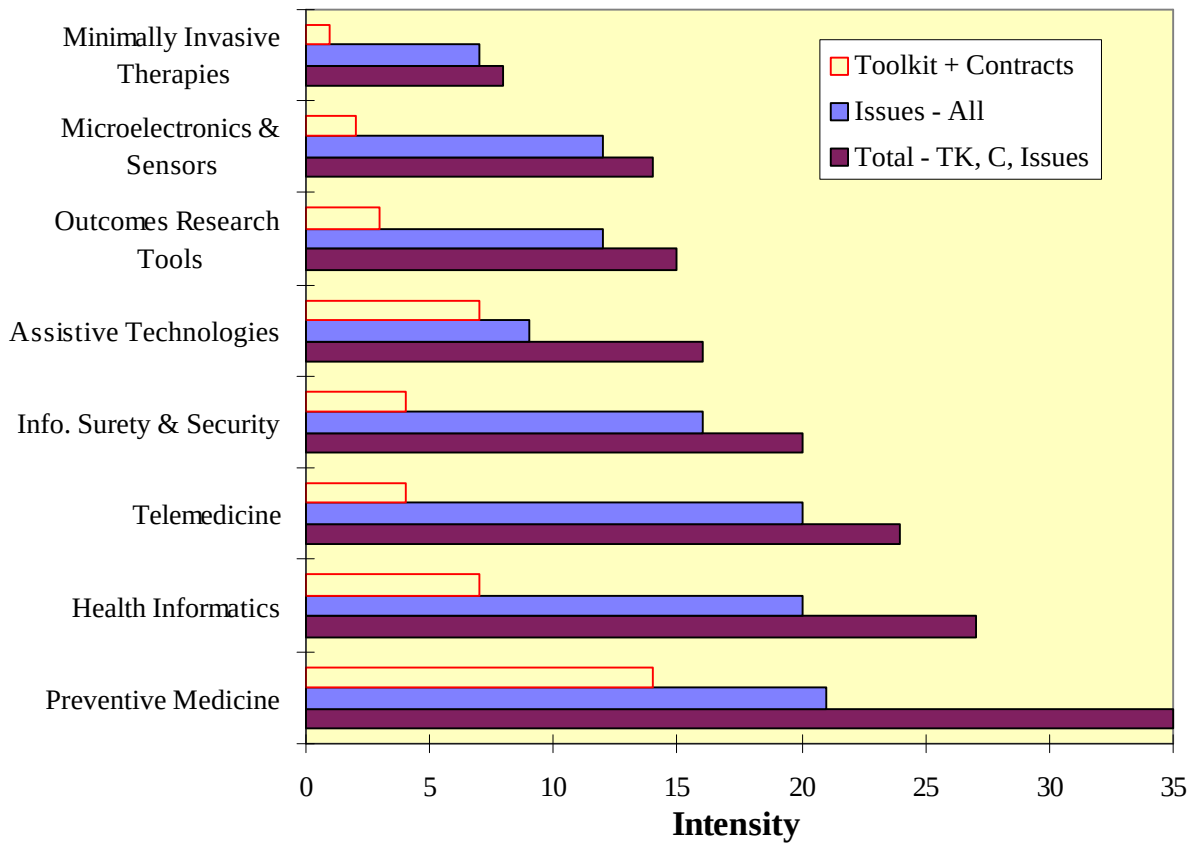
INFORMATION / COMMUNICATION

- Patients and providers need access to health care information and medical records that are accurate and can help make health care decisions about: providers, hospitals, treatments, drugs, technologies, costs and self-care. (Consumers)
- Increase efficiency: 1) maximize use of information technology, 2) adopt other waste-avoiding technologies. (Providers 1)
- Communication. (Providers 2)
- The lack of organized information in a standard format (or the analytic techniques) that systematically allows the evaluation of outcomes that can guide the management of health care. (Insurers)
- Lack of information infrastructure. (Univ/Labs)

PREVENTION

- Improve the consumer's ability to care for themselves in the home and practice preventive medicine. (Consumers)
- Wellness. (Providers 2)
- Public health and environmental health. (Providers 2)
- Episodic acute care does not support preventive health or chronic management. Consumers will become 'change agents'. Applications and technologies aren't focused on consumers. (Insurers)
- Education: Requiring those practicing telemedicine or using the technology to have additional certification. Increase general awareness of shortcomings of technology and existence of possible failures. Awareness of technology licensing (as opposed to stealing). (Lawyers)

Figure 15. Relative Importance of Solution Areas as Demonstrated by Game Play.



AVAILABILITY

- Health care for the uninsured and underinsured. (Consumers)
- Lack of accessibility to health care technologies by the underserved (rural, poor, inner cities). (Univ/Labs)
- Reimbursement for telemedicine - insurers, like Medicare, are reluctant to reimburse for an increase in the number of consultations. Without reimbursement, practitioners will be reluctant to do telemedicine consults. (Lawyers)

DIRECTION / QUALITY

- Keeping the focus on quality: 1) continuous quality improvement (constructive, critical, internal review), 2) commitment to valid outcomes data (to obtain and implement), 3) preserve physician prerogatives (to adopt or test new treatments or technologies within appropriate professional guidelines). (Providers 1)
- Linking independent physicians into effective care delivery units while maintaining entrepreneurial spirit, focus on the patient, and physician leadership. (Providers 1)
- There is no coordinated national program to apply existing technology or develop new technology specifically directed at reducing health care costs and improving quality of life. (Univ/Labs)

REGULATION / LEGAL

- Market facilitation: existing laws, lack of standards, and the regulatory environment limit the rate of advancement of the development, implementation and assessment of biomedical technology. (Legislature)
- Regulatory and economic environments are not conducive to bringing innovations to market. (Suppliers)
- What are the expectations of FDA (acceptable norms, productivity?). (Regulators)
- Unclear standards and expectations for acceptable norms for the approval process. How long should

approval take? How much risk is assumed by the agency or accepted by the individual? (Regulators)
- FDA Image. (Regulators)
- Practicing telemedicine across state lines and the resulting need for multi-state licensure for physicians. (Lawyers)
- There are over 50 jurisdictions regulating the way medicine is practiced and the way medical records are treated. In order to enable interstate practice of medicine with usage of medical records there needs to be one Federal resolution which pre-empts the states in these areas. (Lawyers)
- FDA approval - jurisdiction is dependent upon definition. Definition: what is a device and what is the approval process. Process speed is an issue. (Lawyers)
- Product liability in telemedicine. To what extent will the use of telecommunications to provide medical diagnosis and treatment impose disproportionate liability on manufacturers and distributors of technology? (Lawyers)

METRICS / OUTCOMES
- Outcomes based practice. (Providers 2)
- Assessing cost and quality is difficult enough but 'moving targets' make it worse. Each of the following affects costs and quality in unpredictable ways. 1) New indications for a new technology (units costs decrease but aggregate costs increase), 2) Changes in the technology itself, 3) alternative technologies change, 4) new technologies enter the market. (Legislature)
- How should the benefits of technology application be measured? (viewed from: business, society, patient, providers, employer, family, insurer/payer, vendors, and regulatory viewpoints). (Suppliers)
- There is a disconnect between the intelligent allocation of resources by funding agencies and the effectiveness of those allocations due to a lack of adequate metrics to assess the impact of technologies on: decreased morbidity/mortality; improved quality of life; cost impact on the health delivery system. (Funders)

ASSISTIVE
- Major health problems / assistive technology. (Providers 2)

The matrix of broad issue categories and their solution areas is shown in Table 8. Rows have been shaded for those solution areas in each issue category for which all of the individual issues positively identified the solution area as relevant.

Table 8 shows the following correlations. Health informatics, information surety and security, and telemedicine are the main solution areas to issues in information and communication. Preventive medicine, telemedicine, and microelectronics and sensor are the main solution areas to prevention issues. Note that although microelectronics and sensors was one of the least important categories overall as shown in Figure 15, it is considered critical to the area of prevention.

Telemedicine, legislative and regulatory reform, and funding allocation systems are important to the widespread availability of health care. Preventive medicine, information surety and security, legislative and regulatory reform, and metrics/systems are all considered critical to the overall future direction and quality of health care in this country. Regulatory and legal issues are dominated by the need for reform. Health care metrics and outcomes research are felt to be supported by their own solution areas without much cross-cutting by other solution areas.

It is significant that the majority of the issues were seen to have both technology and policy solutions. In future activities, we must not forget that, in most cases, technology and policy cannot be completely separated.

It is important as the roadmapping effort proceeds, that there be synergy between the roadmapping groups that have been shown here to be common contributors to solutions in various issue areas. For instance, the preventive medicine group should interact closely with the telemedicine and microelectronics and sensors groups when addressing prevention issues. Such synergy will enhance the robustness of the final roadmaps.

Table 8. Matrix of Issue Areas and Solution Areas.

Issue Area:	Information / Communication						Prevention						Availability				Direction / Quality		
Team:	C	P1	P2	Ins	U		C	P2	P2	Ins	Lw		C	U	Lw		P1	P1	U
Issue Rank:	1	3	4	1	2		2	2	5	2	4		3	3	2		1	2	1
Broad Roadmapping Areas:																			
1 Assistive Technologies		1					1				1		1	2					
2 Health Informatics	2	2	1	1	1		1		1	2	1			1	1		1	2	
3 Info. Surety and Security	2	2	1	1	2		1		1	1							1	1	1
4 Microelectronics and Sensors			1	1			1	1	1	1	1			1					
5 Minimally Invasive Therapies		1						1			1								
6 Outcomes Research Tools	1		1	2	1				1								2		
7 Preventive Medicine		1	1	2			1	2	2	2	1		2	1			1	1	1
8 Telemedicine	1	1	2	1	1		1	1	1	1	1		2	1	2				
Other Policy Areas:																			
1 Legislative/Regulatory Reform		1	1	1					2	1	1		1	2	2		1	2	2
2 Tort Liability Reform				1			1			1	1								
3 Metrics/Systems for Cost/Quality	1			1	1					1							2	1	1
4 Funding Allocation Systems			1	1					1	1			1	1	2				2

Issue Area:	Regulation / Legal										Metrics / Outcomes					Assistive Tech.		
Team:	Lg	S	Rg	Rg	Rg	Lw	Lw	Lw	Lw		P2	Lg	S	F		P2		
Issue Rank:	1	2	1	2	3	1	1	3	5		1	2	1	1		3		
Broad Roadmapping Areas:																		
1 Assistive Technologies								1	1			1				2		
2 Health Informatics	2						1	1	1		1	1	1					
3 Info. Surety and Security			1					1	1			1	2					
4 Microelectronics and Sensors								1	1			1				1		
5 Minimally Invasive Therapies								1	1			1				1		
6 Outcomes Research Tools								1			2	1	1	2		1		
7 Preventive Medicine		1	1	1	1			1	1			1				1		
8 Telemedicine						1	1	1	1		1	1				1		
Other Policy Areas:																		
1 Legislative/Regulatory Reform	1	2	1	1	1	1	1	1	1			1	1	1		1		
2 Tort Liability Reform	1			1					1		1					1		
3 Metrics/Systems for Cost/Quality	1		1	1	2						2	1	2	2				
4 Funding Allocation Systems			1											1		2		

Roadmapping

Session 6 of the Prosperity Game was devoted to the initial stage of developing roadmaps for several areas of biomedical technology and policy. The solution areas roadmapped in Session 6 were selected and grouped real-time by looking at the issues generated in Session 5 and making judgments as to which were the most heavily represented. Facilitators were provided to guide the roadmapping effort in the following ten areas:

- Assistive technologies
- Education technology
- Health informatics
- Information surety and security
- Minimally invasive technology / Sensors / Robotics / Energy delivery systems / Advanced diagnostics
- Outcomes research tools / Data mining
- Preventive medicine / Environmental health / Incentive programs
- Telemedicine
- Legislative and regulatory reform
- Funding allocation systems

These solution areas and groupings are somewhat different than those shown in the section on 'Health Care Issues and Solutions.' Post-game analysis of the issues and game agreements allowed refinement of the solution areas to those used in the follow-on roadmapping effort.

For the roadmapping session, the teams representing the various stakeholder groups were split up, and each player was allowed to participate in the roadmapping group of his or her choice. It was very interesting that, although legislative and regulatory reform was listed as a solution area to all but a few of the issues, no players chose to work on solutions in that area.

The groups were encouraged to use the template shown in Figure 16 to map the future for their technology areas. Definitions for each of the terms used in the template are given in the figure. A separate template was provided for policy areas with the following outline:

- Issue (including background)
- Proposed solution
- Positives, negatives
- Costs
- Actions (including responsible party)

The policy template was used in only two instances. A list of the areas for which initial roadmaps were developed is given here. The full set of roadmaps and policy issue sheets is given in Appendix L.

Assistive technologies
Health informatics - architecture/system
Health informatics - expert system
Health informatics - NII
Health informatics - security, privacy
Health informatics - standards
Health informatics - terminology
Medical information surety
Information surety and security (P)

Figure 16. Biotechnology Roadmap Template.

GENERAL TECHNOLOGY AREA:			
Vision of the future for the technology area: A high-level view of the purpose of the particular technology area in health care.			**Champions:** People who will lead further roadmapping activities.
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Goals identifying the future advances in the technology area.		
Drivers:	Specific characteristics of technologies that must be available to achieve the desired objective.		
Sub-technologies:	Classes of technologies that hold promise in enabling the objective.		
SponsoringOrgs:	Potential funders, researchers, etc., related to drivers or subtechnologies.		
Attributes:	Specifics related to the objective, such as cost, size, speed, policy, etc.		

Minimally invasive therapies - energy delivery
Minimally invasive therapies - imaging
Minimally invasive therapies - robotics
Minimally invasive therapies - tissue manipulation
Outcomes research
Preventive medicine (P)
Advanced diagnostics - noninvasive
Advanced diagnostics - predictive
Advanced diagnostics - predictive (heart)
Education technology
Telemedicine
Funding allocation systems

This initial work formed the basis for the detailed roadmapping activity which has been done both off-line and in a formal workshop.[4]

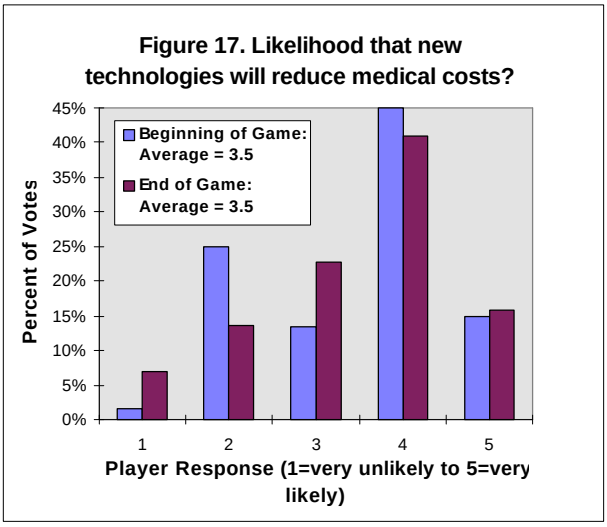
GAME EVALUATIONS BY PLAYERS

Specific Objectives

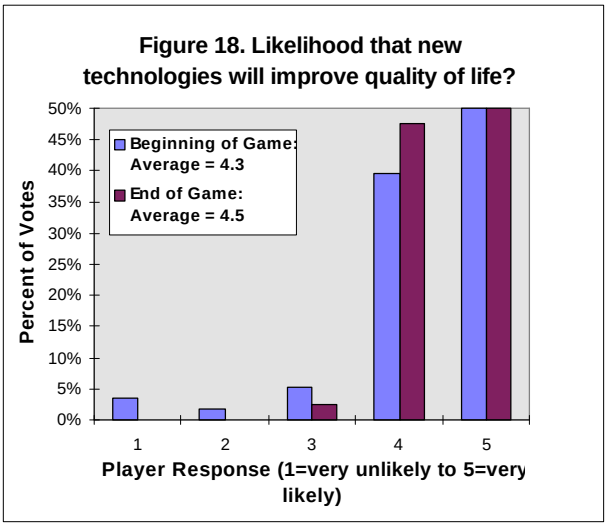
The primary objective of the game and roadmapping events was to identify critical technology issues that affect the cost and quality of health care. The game successfully identified and prioritized many of these issues. It also demonstrated the great importance of policy in lowering costs and maintaining or improving quality.

The players were asked several questions at the start and end of the game to measure their attitudes and any change that might have occurred over the brief course of the game.

Figure 17 shows that the players were modestly optimistic that new technologies could reduce medical costs. The average score of 3.5 did not change over the game, although some individuals increased or decreased their beliefs. At the start of the game, 60% felt positively (voted 4 or 5) that costs could be reduced. This was almost unchanged (57%) at the end of the game.

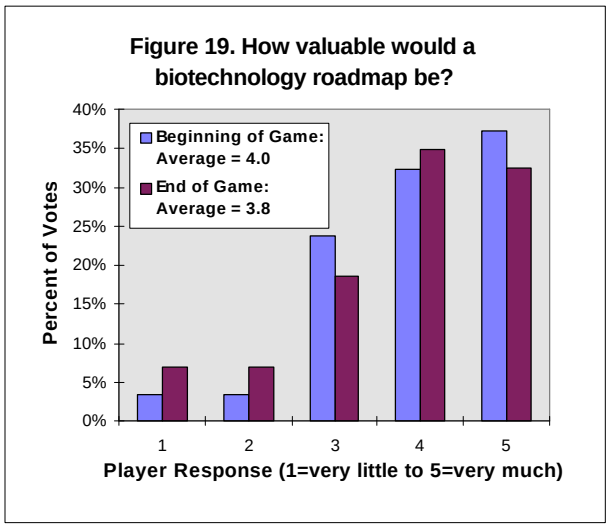


The players were much more sanguine about prospects for improving the quality of life as a result of new technologies. Figure 18 shows an average score of 4.3 at the game's start rising slightly to 4.5 at game's end. 90% of players scored a 4 or 5 at the start, and 98% after the game.

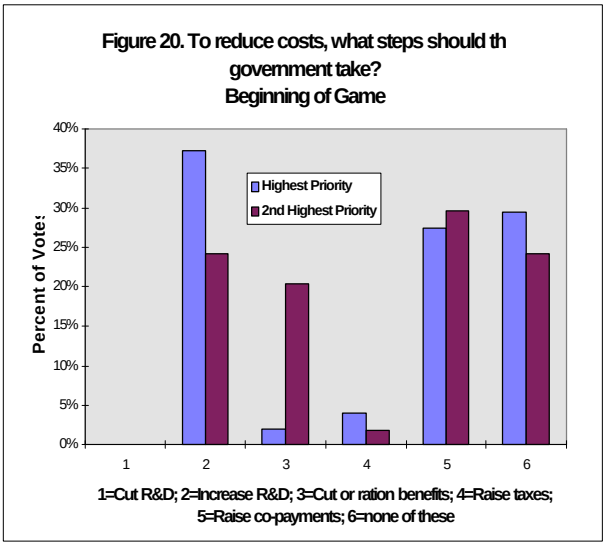


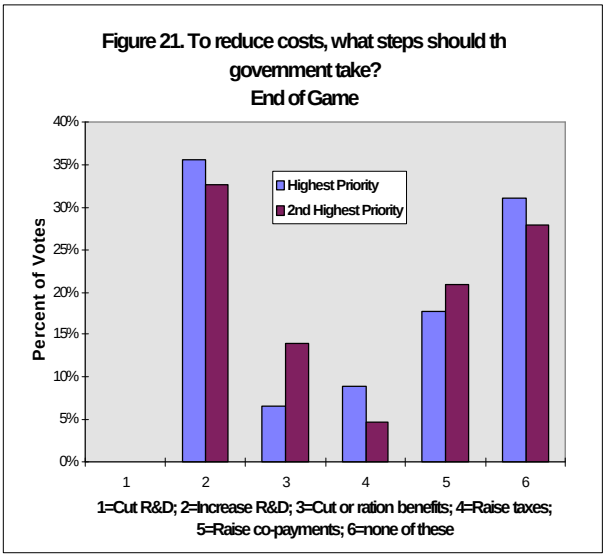
[4] Biomedical Technology Roadmapping Workshop, April 22-24, 1996, Albuquerque, NM. For more information, contact Donald L.Wesenberg, Sandia National Laboratories, (505) 845-0194, dlwesen@sandia.gov.

The players were quite positive about the value of a biotechnology roadmap at the start of the game, with an average score of 4.0, and 69% voting a 4 or 5, Figure 19. By the end of the game, this optimism was reduced slightly to an average score of 3.8, but the number of 4s and 5s didn't change (68%). The slight reduction might have been due to the game design, or to the players learning more about the actual process of roadmapping.



Figures 20 and 21 show the players' recommendations for steps the government should take in attempting to lower costs. No one suggested cutting R&D, either before or after the game. On the contrary, the highest scores both before and after the game were assigned to government increases in R&D. The second highest scores were assigned to increases in copayments and "none of these." Very few players supported cutting/rationing benefits or raising taxes.



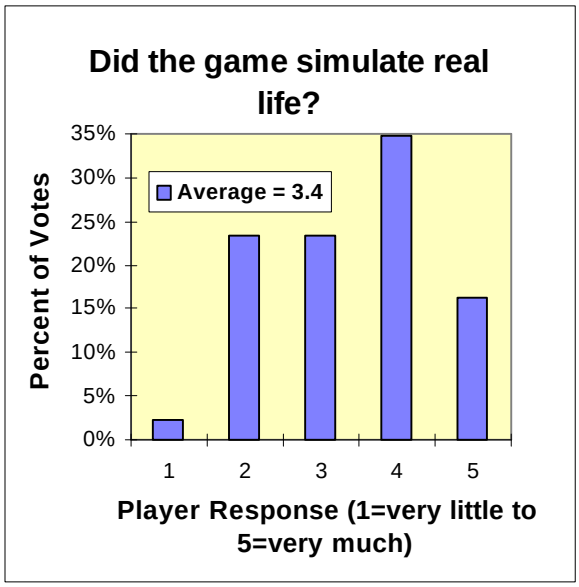


Generic Objectives

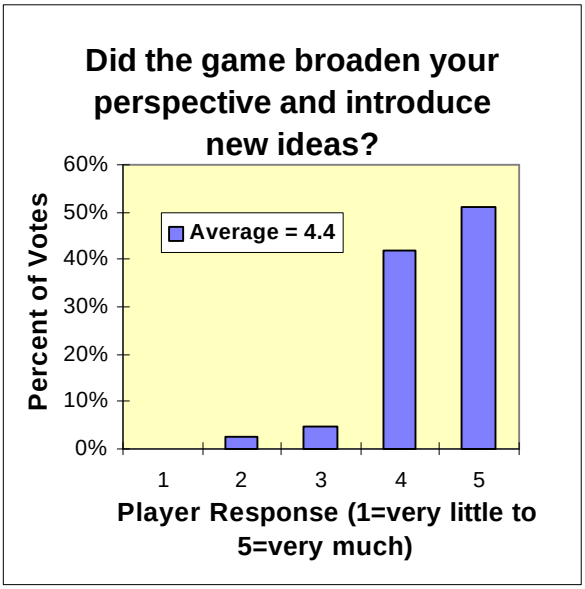
As in previous games, the players were asked to evaluate how well this event accomplished the generic objectives of Prosperity Games. Answers to these questions allow us to continue to improve the quality of the games.

Almost all players had a rewarding experience. 93% voted a 4 or 5, with an average score of 4.4, the highest recorded for any game.

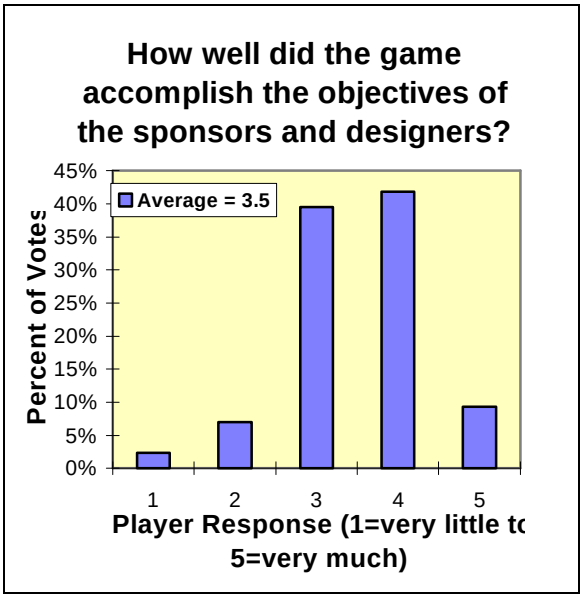
Despite the enormous complexity that the game tried to model, almost half the players felt that the game simulated real life well or very well; the average score was 3.4. One person thought the reality was very poor, and 23% felt it was poor.



93% of the players felt that the game broadened their perspectives much or very much (4 and 5). The average score of 4.4 was the highest recorded for any game.



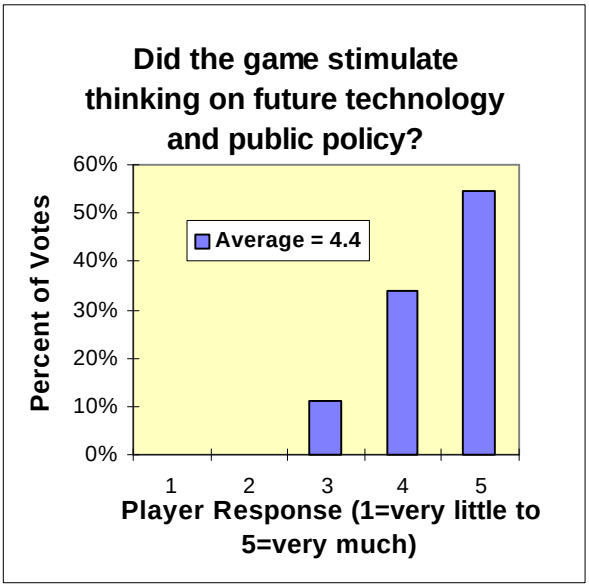
Half the players felt the game accomplished the sponsors' objectives well or very well (4 or 5). One person felt that the objectives were very poorly met. The average score was 3.5.



In contrast, the players felt that the game met their objectives very well. The average score was 4.0, the highest recorded to date.

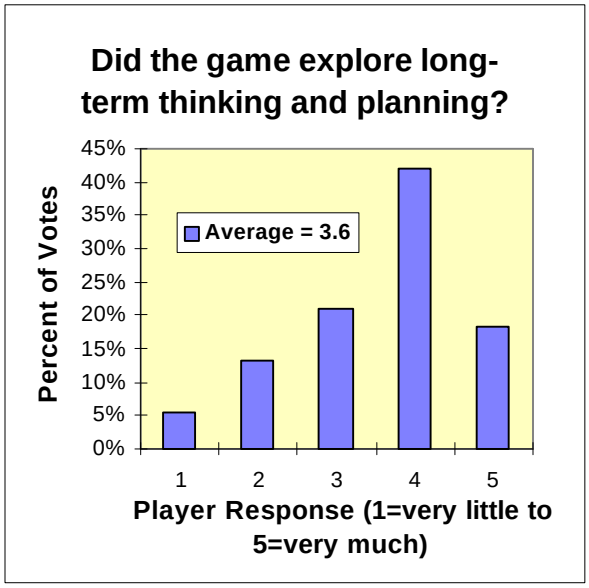
Interest and enthusiasm in the game was very high, with an average score of 4.3.

The game and roadmapping were also very effective at stimulating thinking on future technology and public policy, with an average of 4.4.



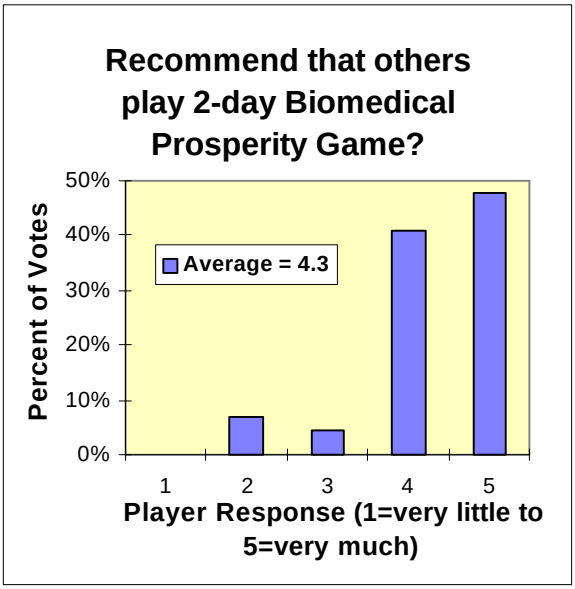
Understanding of the roles and relationships of the many stakeholders was improved as a consequence of the game, with an average score of 4.0, the highest recorded to date.

Long-term planning was explored well or very well for 60% of the players. 18% felt that this exploration was poor or very poor.

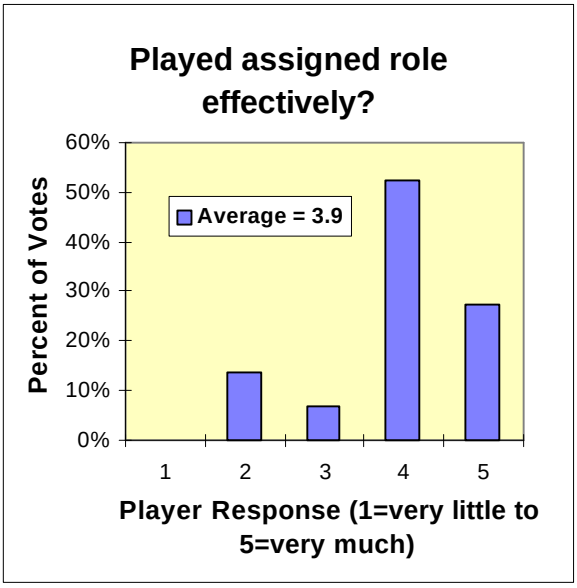


74% of the players believed that the event was well worth the time spent (4 or 5); the average score of 4.0 was the highest among the three games in which this question was asked.

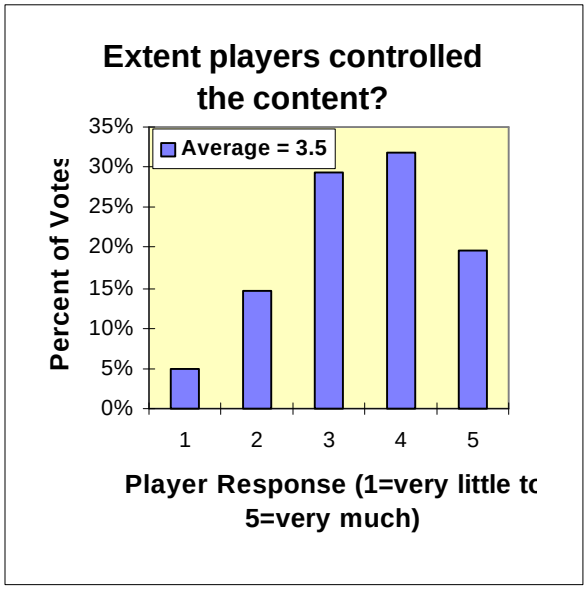
Almost all the players would recommend a similar game to others, with an average score of 4.3.



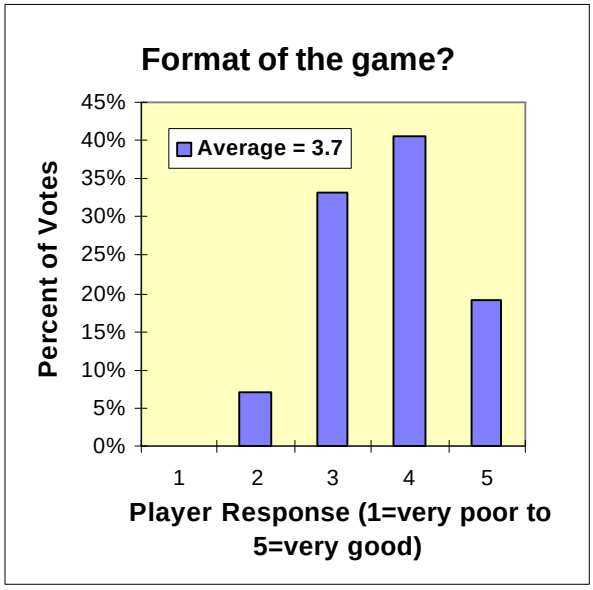
Most players felt that they were able to play their assigned roles effectively. 14% said that they had some difficulty.



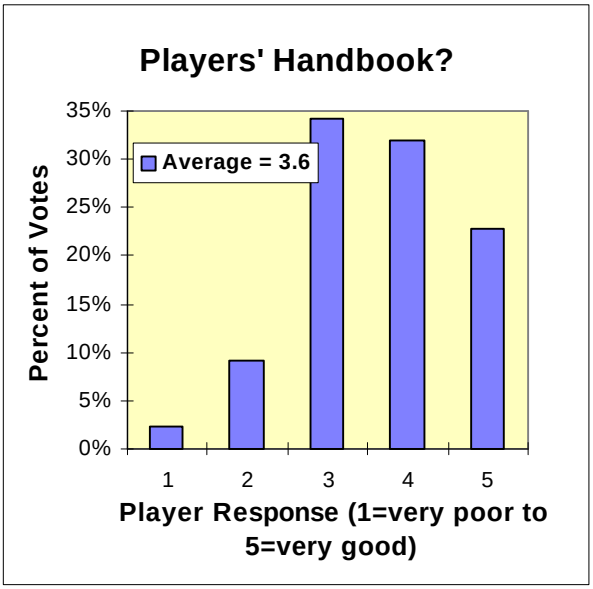
Most players felt that they controlled the content; however, 8 players felt that their control was little or very little.



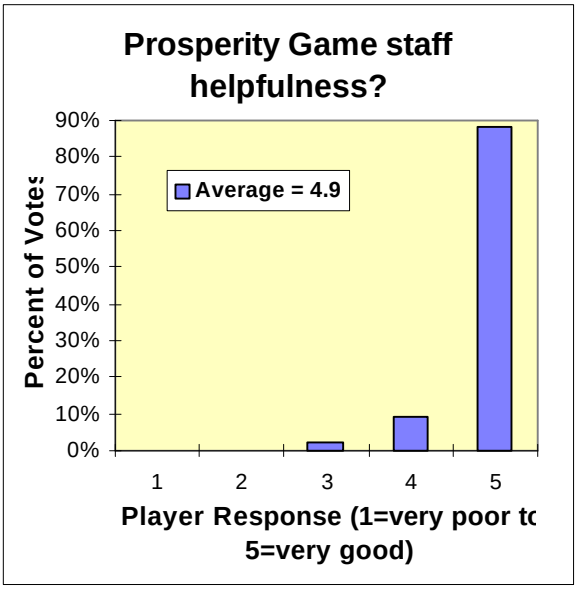
92% of the players rated the game format from neutral to very good (3, 4 or 5). Three players rated the format as poor.



Similarly, 89% rated the Handbook neutral to very good; 11% rated it poor to very poor.



The players rated the staff very highly, with an average score of 4.9.



Based on these evaluations, this game was among the very best games conducted so far. A comparison of the average scores for ten previous games is shown in Table 9. The shaded entries indicate those scores that were the highest or close to the highest scores recorded among these games.

Table 9. Comparison of Average Evaluation Scores of all Games.

Question and average responses by game	EIA	AEA	Adv Mfg	NEMI		ENVIRONMNT		DOE/Diversity		BIOMEDICAL	
				proto	final	proto	final	proto	final	proto	final
Rewarding experience						3.91	4.17	3.71		4.18	4.40
Simulate real life						3.49	3.63	2.85		3.57	3.40
Broaden perspective/introduce new ideas						3.85	3.38	3.38		3.79	4.42
Accomplish sponsors' objectives						3.51	3.43	3.12		3.58	3.49
Meet your objectives						3.57	3.61	3.14		3.93	4.02
Maintain your interest and enthusiasm			4.29	4.61		4.02	4.02	3.65		4.24	4.28
Stimulated thinking on future technology policy	4.07	3.68	4.29	4.64	3.83	3.56	3.37	3.97		4.14	4.43
Facilitated understanding of roles and relationships (develop relationships among players)	(3.33)	(3.05)	3.53	3.46	(3.94)		3.64	3.74 (3.69)		3.76	3.95
Explored long-term thinking and planning	4.02	3.68	3.59		3.89	3.02	2.69	3.26		3.57	3.55
Laid foundation for industry to make tech roadmap (How valuable would a roadmap be?)	3.70	2.42			3.38			3.08		(4.30)	(3.79)
Would you play a full 2-day game with peers	3.74	3.95	3.82			3.78				3.80	
Was this event worth the time spent?							3.71	3.61			4.00
Recommend that others play full 2-day game	4.31	4.16			4.36	4.13	3.86	4.15		3.90	4.30
Format of the games	3.31	2.68		3.61	4.25	3.72	3.73	3.03		3.76	3.71
Innovator decision aid	4.12	4.05			3.38						
Players' Handbook	2.87	3.00			4.29	3.73	3.91	3.22		3.37	3.64
Prosperity Games staff helpfulness/effectiveness?	4.09	4.53			4.79	4.49	4.88	3.68		4.67	4.86
Able to play assigned role effectively	2.96	3.11	3.82			3.89	3.93	3.53		4.10	3.93
Players controlled the content	4.38	4.42			4.59	3.66	3.66	3.91		3.75	3.46

LESSONS LEARNED

The continued growth and improvement of Prosperity Games depend on learning from past games and applying these lessons to future games. Comments were received from players, analysts and facilitators concerning perceived successes and flaws in this simulation. Some of these suggestions have already been incorporated into game design and execution.

This game incorporated several new ideas and experiments. The most important of these was the attempt to combine the beginning of the development of a technology roadmap in conjunction with the simulation. Another was the great complexity involved in simulating both the patient-doctor-hospital-insurance relationships in providing health care, and the nation's research establishment that involves many stakeholders, including public and private funding agencies, congress and state legislators, universities, laboratories, suppliers, manufacturers, and regulators; the legal system also impacts all aspects of the health care delivery process.

To accomplish this broad-based simulation required several compromises. The game itself was shortened to one day from the usual two. Since the second day is generally more productive than the first (due to the players' increased expertise and focus), some players felt they were just coming up to speed when we switched to roadmapping. Potential improvements include extending the event by one day, reducing the time devoted to roadmapping, and smoothing the transition between the two elements.

Most players felt that changing teams and facilitators hindered progress. As we have often observed, most players bond strongly to the team (although some individuals do not). Involuntary removal from a team has invariably produced negative personal dynamics in previous games. Hence, it is probably preferable to maintain the team's composition and facilitator, and structure the roadmapping

objectives to match the team's interests and expertise.

General Comments

ENVIRONMENT:
- Noise level too high. Consider separate rooms.

GAME DESIGN:
- Needed competing supplier teams.
- More time for playing the game would have been very helpful.
- Complexity of health care might warrant a longer game-playing process.
- Add an additional day for game.
- Need a much longer, more detailed game. This could evolve over weeks/months.
- Have a lawyer on every team.
- Need two insurance teams.
- Need to explicitly consider medical ethics.
- More emphasis on policy and less on technology.
- Technology is a tool; a means but not an end.
- Game mirrored much of reality in technology R&D.
- More homework needed for participants.
- Need longer orientation.
- Liked the chaos. Simulated real life. Much better than a symposium.

MONEY:
- Money is the blood of the health care organism.
- There was too much money in the game.
- Funding allocations were very confusing.

PLAYERS:
- Many players seemed to have a vested interest in telemedicine; others were strongly opposed.
- More diversity. Group was too homogeneous.
- Too few technologists.
- Some other teams needed a better understanding of their roles.
- Choose players who can transcend their subspecialties.

PROCESSES:
- Computerize entire process.
- Need more real-time feedback.
- Both halves (game and roadmap) of the experience were valuable.
- Announce transitions between sessions.
- Need more breaks.
- Highly enlightening experience, both for content and process of the game. Time management was excellent.
- No banquet on second night.

ROADMAPPING:
- Let the teams select the areas to roadmap.
- The roadmap exercise was not satisfying. I feel the facilitator became too personally involved.
- Facilitator drove own ideas; discussion was discouraged.
- Changing facilitators was detrimental.
- The gaming and roadmap combined exercise works!
- I hope your roadmap also shows the necessary interplay required between policy and markets.
- Need a block for "barriers" - helps to identify the roadblocks to implementing the ideas.
- Only on second day was it possible to think through real possibilities for innovation.
- Game was lots of fun, very educational. An intense experience. Roadmapping seemed a little unfocused by comparison.

GAME BENEFITS:
Most players greatly enjoyed the game and benefited from the experience.

"Very useful and informative. I am hoping the resulting report and roadmap will become key

tools in setting and implementing a proactive legislative agenda."

"The role playing game was a well designed model for the generation of a technology forecast. It identified needs for technology development based on outcomes."

"The game showed me the complexity of technology implementation in a highly regulated environment.

"Challenging, stimulating. Quickly brought into focus driving forces directing health care systems and application of technologies to meet mission, goals and objectives."

"Great collaboration with Universities/Labs R&D."

"Sandia's attitude and understanding of quality assurance and the importance of good research will be the grease for the skids through the FDA approval process."

"Game was well managed and supported. Wonderful having Sandia staff facilitating at each team."

"Despite the time limitations, the game was often very realistic in behaviors and reactions."

"A wonderful, stimulating, occasionally frustrating experience."

"Very well organized, well run and well thought out game."

"This was a great experience. I learned a lot."

"Wonderful experience - thanks for inviting me."

"The game was excellent: intense, forced me to think 'outside the box.'"

"I wanted you to know how much I enjoyed participating in the Biomedical Game."

"I found the format and the intellectual content quite stimulating. What a strong, effective concept."

"It was a memorable learning experience."

"I thoroughly enjoyed the Game.... The game was well designed and the control team did a wonderful job balancing reality with time constraints."

"Control group was great - fast and good decisions."

"Outstanding simulation of the health system complexity.

"For me it provided validation and added breadth to my prior life experience base and my existing perceptions of the roles of others.... I can now reenter my work universe with more assurance relative to choices about allocation of effort and resources, with ideas for some new projects."

"Staff was wonderful."

"A fantastic experience overall."

"Greatest workshop I ever attended!"

ACKNOWLEDGMENTS

A complex event such as this requires the efforts and encouragement of a large number of people. Funding was primarily provided by the Information Systems Engineering Center at Sandia National Laboratories for the U. S. Army Medical Research and Materiel Command. Additional funds were provided by the Technology Partnerships and Commercialization Center at Sandia. Sandia is a prime contractor for the US Department of

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Dr. Fidel Davila from Scott and White Clinic in Temple, Texas did an enormous amount of work on developing the disease/disability cards and participating in both the prototype and actual games. His help, expertise and enthusiasm are greatly appreciated.

Staff from Sandia and its contractors provided outstanding facilitation for the game and analyses of the results.

Sixty-seven players and twenty-seven staff committed themselves to the success of this game, and their efforts are greatly appreciated.

APPENDIX A: ADDITIONAL PLAYERS HANDBOOK INFORMATION

PLAYING THE GAME

The Prosperity Game/Technology Roadmap exercise includes seven sessions or distinct time periods. Sessions 1 through 4 comprise the Prosperity Game simulation. It explores empathic and learning experiences, collaborative and competitive interactions, experimentation, decision making, and innovation. The game and life experiences of the players are collected, discussed, prioritized and documented in the roadmapping exercises of Sessions 5 through 7. A final debriefing allows the teams to share their experiences with the entire group.

The primary "move" in the game is represented by an agreement or contract. These agreements are negotiated among two or more teams and must represent an exchange of value for value. Figure 1 shows the form used for documenting agreements. No agreement is official until signed by all parties and the Control Team, with representatives of all parties present. If the agreements involve uncertain future outcomes, these will be determined probabilistically by the Control team for the final execution. The agreements must be accompanied by the amount of money being transferred between partners. Two secondary "moves" include investments in Toolkit options, and D/D cards with their associated outcomes, costs, and quality evaluations.

All teams are provided with a list of near-term and long-term challenges (see pages 67-71). This information, coupled with the experience and expertise of the players, launches them into the real-world simulation of the game. The game is "won" by successfully meeting the prescribed challenges and accomplishing the long-term objectives of the teams and individual players. Circumventing the game is not winning. Players should seek to accomplish their goals following the most realistic alternatives available.

Session 1: 1996-1997 This session is for strategic planning and organizing your team to best deal with the coming events. Decide on groundrules for making decisions, who will play what roles on the team, assignment of responsibilities, processes for accountability and correcting errors. Resolve outstanding questions about the game. Review your current state and where you would like to be in 8 - 10 years. Discuss the challenges provided in this Handbook and add others of your choosing; prioritize the list. Review the detailed descriptions of your team and other teams, and know the deadlines and deliverables (penalties for missing deadlines can be severe). No money is disbursed in Session 1. However, consumers need to prepare for purchasing insurance at the start of Session 2. The insurance team must have policies completed and be ready to discuss these with the consumers prior to the end of Session 1. Three sample policies will be provided: private/independent, private/HMO, and government. If insurers miss their deadline, the sample policies become official and they must make these available to the consumers. Legislators need to develop a budget to insure that appropriations to all other teams are completed at least five minutes before the start of Session 2.

Figure 1. Form for all agreements and contracts

AGREEMENT FORM

THE TERMS AND CONDITIONS OF THIS AGREEMENT ARE AS FOLLOWS

_____

_____

_____

_____

_____

_____

_____

50% Probability Cost: $_____ _____ _____
Control Team Time

APPROVALS AND FUND TRANSFERS:

Team Transferring	Amount	Team Receiving	Transferring Team Signature
_____	$_____	_____	_____
_____	$_____	_____	_____
_____	$_____	_____	_____
_____	$_____	_____	_____

Investment was: ☐ Successful ☐ Unsuccessful

Approval by: _____ _____ _____
Control Team Date Time

In the event that legislators miss their deadline, the Control team will appropriate 1998 funds according to the same percentages as in 1996. Research funders plan their 1998-1999 expenditures in discussions with universities/national labs, the legislators, and others.

Session 2: 1998-1999 The legislators appropriate their funds and the team recorder (staff person assigned to team) disburses these funds to the appropriate teams. Patients buy insurance. Patients (Consumer team) randomly select D/D cards from their team recorder. Patients are responsible for the entire D/D process. They get two copies of D/D-Quality cards from the Control team, along with appropriate props (e.g., blindness is simulated with foggy glasses or blindfolds; wheelchairs or walkers are available, etc.). They go to providers in search of relief or cures. Providers diagnose and treat patients with current technologies. Patients must obtain insurance money and pay for services provided - no charity. Analysts and/or Control team calculate treatment outcomes and related costs based on algorithms and probabilities generated earlier. Results are provided to patients and physicians and implemented or simulated. If patients are not returned to health in two years (one session), then they continue their treatment in the next session. If they are completely cured, they then pick new D/D cards. Patients undergoing diagnosis or treatment can use their time as efficiently as they wish. They may think, read magazines, or, if their condition permits, they may negotiate with each other and with other teams to accomplish their goals (e.g., they may lobby the legislature for action in certain biomedical technology areas). Patients who die cannot return to their original teams until the next session.

The Providers are also given four team D/D cards that will stimulate discussion of priorities over the course of Sessions 2 - 4. Providers should also consider purchasing malpractice insurance from the lawyers.

All teams must complete their Toolkit investments and turn them in to Control team by the middle of Session 2. Teams are responsible only for their own Toolkit investments. However, they are encouraged to discuss pooling their Toolkit resources with other teams to increase the likelihood of success. Those discussions can be informal or formalized by an agreement between two or more teams. However, the Control team will only acknowledge each team's individual Toolkit submission. Session 2 also creates the basic kernel for Sessions 3 and 4.

Figure 2 illustrates some (not all) of the possible interactions that could occur during Sessions 2 - 4. This experiential process develops the relationships and provides the inputs and innovative thinking that are used in the development of the Biomedical Technology Roadmap.

Other teams play their roles, negotiate with each other, and interact with consumers and providers. They develop research plans; get sponsors and funding; get products patented, licensed and manufactured for use in subsequent years. The flow of money between teams is sketched in Figure 3.

Figure 2. Schematic of Some Possible Team Interactions

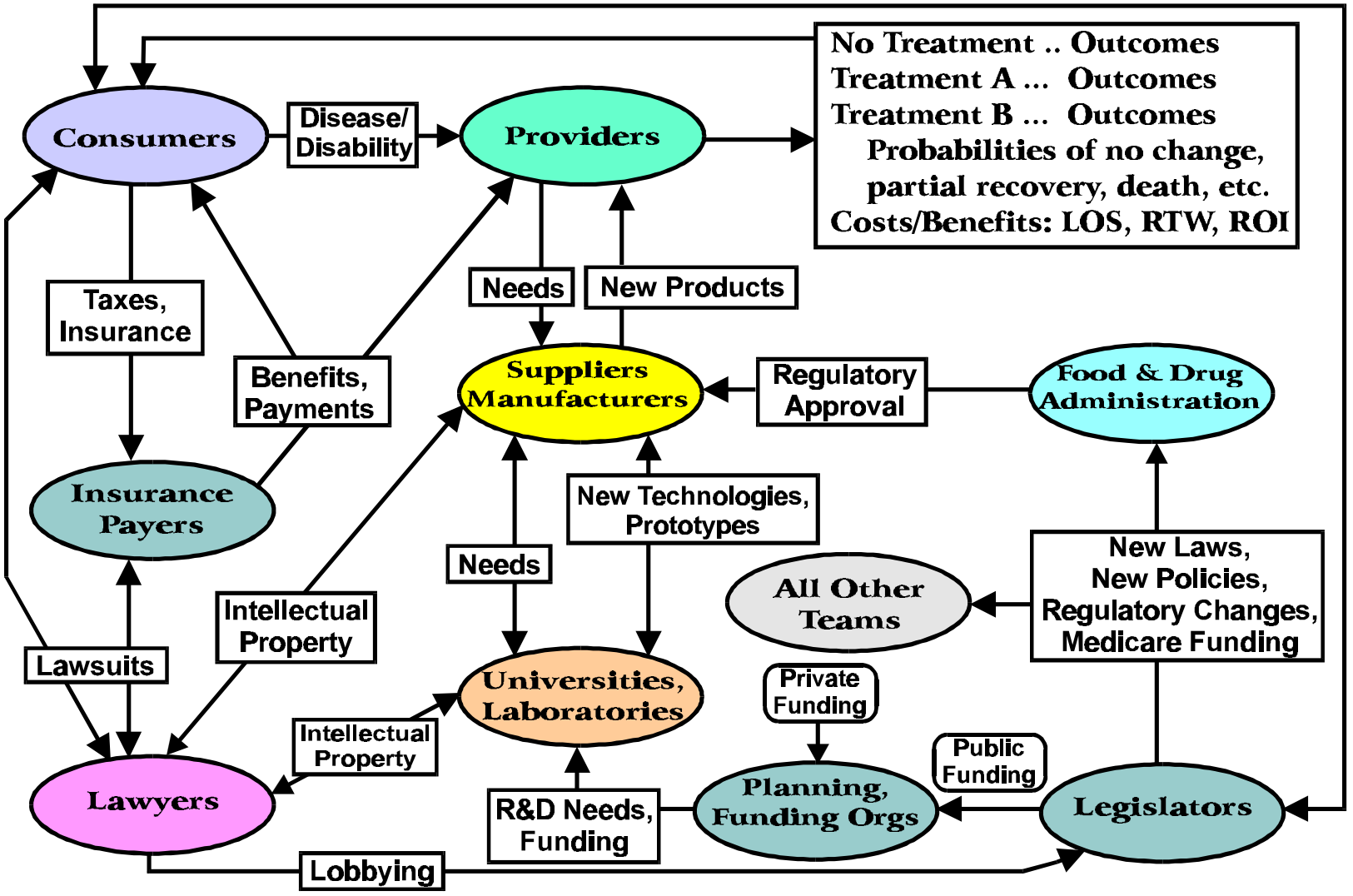

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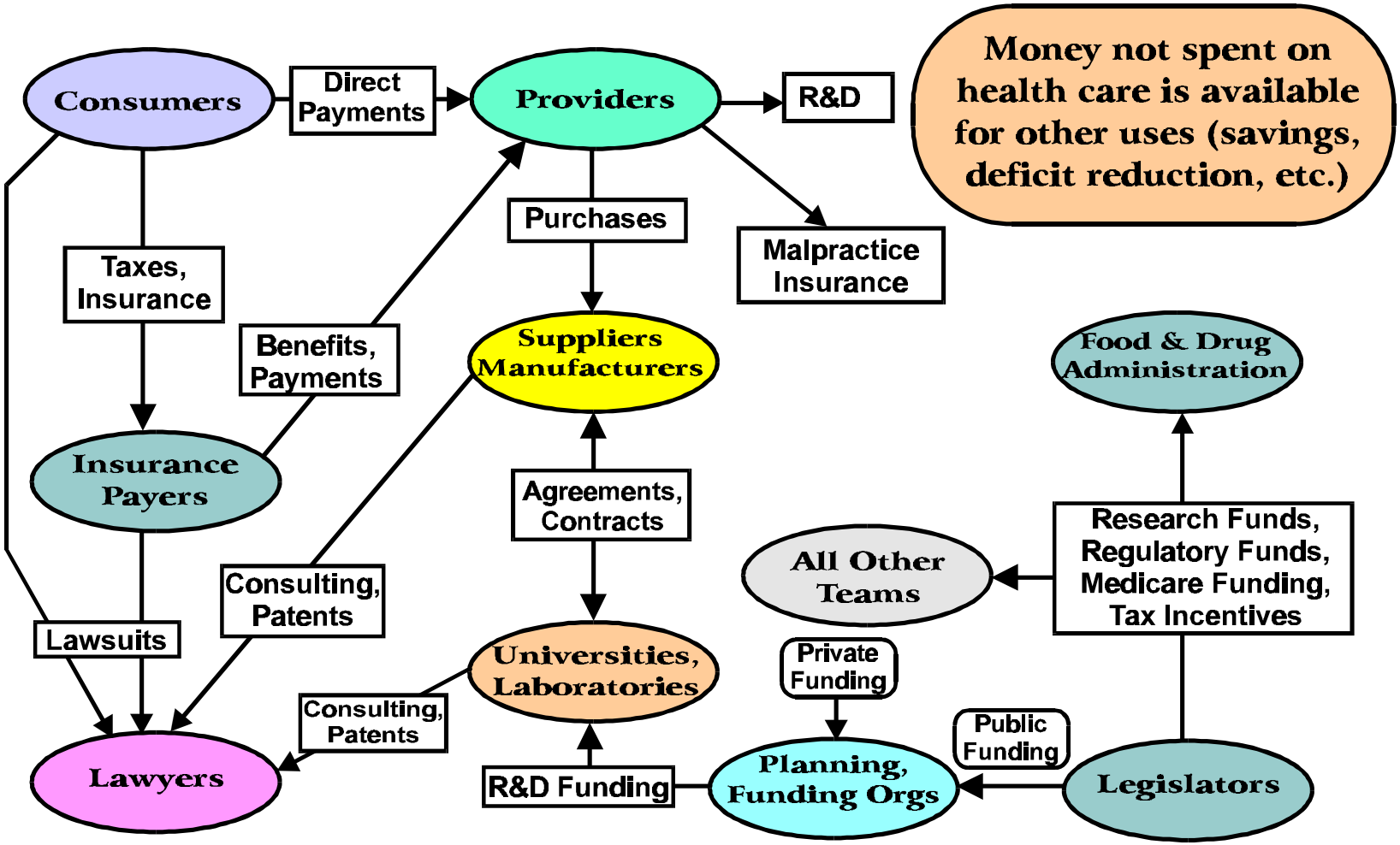
Figure 3. Flow of Money Through the System



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After the Toolkit option investment period ends, the teams must use the "standard" realistic processes for developing and marketing new technologies. No Toolkit investments carry over to this process - all teams start from scratch. They may begin development of Toolkit options that failed, or create their own technologies. Table 1 illustrates the full process for technology development, licensing and marketing as it currently exists. Changes and improvements in this process can be accomplished in the game by negotiating agreements among all affected stakeholder teams. All determinations of future results (e.g., successful research, successful clinical testing, etc.) are determined probabilistically after assigning a mean investment and mean time. In the context of the game, all specified long-duration events (such as conducting clinical trials) can be assumed to have already been accomplished in the event of a successful outcome. Representatives from all negotiating parties must bring the agreements and money to Control for acceptance, probabilistic determinations, and confirmation. Players are encouraged to develop ideas that will simplify and speed up this process.

Table 1. STANDARD PROCESS FOR TECHNOLOGY DEVELOPMENT

Action	Affected Teams	Move
Funding agencies get money for desired R&D	Legislators, Funding Orgs, Universities/Labs, et al.	Agreements - money transfer
Disburse funds	Funding Orgs, Universities/Labs, et al.	Agreements - money transfer
Perform R&D	Universities/Labs, Suppliers/Manufacturers	Agreements - probability assignment and dice roll; possibly money transfer
Secure intellectual property rights	Lawyers, Universities/Labs, Suppliers/Manufacturers, Control team = patent office	Agreements - money transfer
Negotiate terms (time, cost, etc.) of clinical testing and conduct trials	FDA, Universities/Labs, Suppliers/Manufacturers	Agreements - probability assignment and dice roll; possibly money transfer
Get FDA approval	FDA, Universities/Labs, Suppliers/Manufacturers	Agreements - possible money transfer
Manufacture technology and products	Suppliers/Manufacturers, Control team	Agreements - money transfer
Sell technology to providers	Suppliers/Manufacturers, Providers	Agreements - money transfer
Convince insurers to cover treatment costs	Suppliers/Manufacturers, Providers, Insurers	Agreements - money transfer
Technology becomes available for treating patients.		

Session 3: 2000-2001 Successful Toolkit options will be announced and implemented into the game. Session 2 activities will continue. Consumers will select new D/D cards depending on previous outcomes. Doctors may use any new technologies developed (and FDA-approved) over the last two years. Policy changes in insurance,

regulatory requirements, etc. will also be incorporated into the game. Champions of particular technologies and policies should pursue the agreements necessary to bring their ideas to fruition.

Session 4: 2002-2003 Repeat Session 3 updated two more years. The simulation ends at the end of Session 4. Late advances and successes will be documented in the final report of the game.

Session 5: Identify Problems and Solution Areas: This session begins the roadmapping efforts. Based on the game and life experiences, each team identifies the most important issues, problems, challenges and potential solutions for employing technologies and related policies in reducing costs and increasing quality. These issues are prioritized and then the top one or two issues and their rationales are presented to the entire group in plenary session. Table 2 shows the template (with example) that will be used to identify issues and solutions and categorize these into major technology and policy areas. At the end of Session 5, players will be polled to determine their first choice for an area to pursue in greater depth.

Session 6: Roadmapping Technologies and Policies: The information produced in Session 5 will be assembled into the form shown in Table 3. The team tables will be relabeled according to technology and policy areas. Players will move to those tables that are of primary interest to them, based on the preferences expressed at the end of Session 5. Tables may contain one or two areas. In the first ten minutes, the reassembled players will then create a vision statement for the future of their technology or policy area (with a minimum amount of wordsmithing!). They will then begin to flesh out their thinking on the key elements of a Biotechnology Roadmap. Table 4 shows a template (with example). Following are definitions of key terms that may be useful in this endeavor:

DEFINITIONS:

Vision - A high-level view of the purpose of the particular technology area in health care.

Champions - People who will lead, provide guidance for and participate in further roadmapping exercises. It is likely that champions will be responsible for organizing the teams who will create and document the roadmaps.

Objectives - Goals identifying the future advances in the particular technology area.

Drivers - Specific characteristics of technologies that must be available to achieve the desired objective.

Sub-technologies - Classes of technologies that hold promise in enabling the objective.

Sponsoring organizations - Potential funders, researchers, etc., related to the sub-technology classes or technology drivers.

Attributes - Specifics related to the objective, such as cost, size, speed, policy, technical requirements, etc.

Table 2. THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to issue):	**Team:** Consumers
There is a general lack of access to the most recent and effective technologies in rural areas.	**Issue Number:** 1
	Relative Priority: 4 **(1=very low to 5=very high)**
	Priority Ranking: (1=first, etc.) 2

Possible Solutions:

- *Increase number of doctors in rural areas using government subsidies.*
- *Offer government loans for medical education for students who will spend five years in rural areas.*
- *Link rural areas to major medical centers through telemedicine.*
- *Make new technologies more mobile; bring to rural areas on a scheduled or emergency basis.*

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		**Technology-Specific Policy Areas:**	
1 Advanced Diagnostics	*X*	**1 Legislative/Regulatory Reform/Improve**	
2 Assistive Technologies	*X*	**2 Incentive Programs**	*X*
3 Energy Delivery Devices		**3 Information Surety and Security**	
4 Health Informatics	*X*	**4 Tort Liability Reform**	
5 Microelectronics and Sensors	*X*	**5 Metrics and Systems for Cost/Quality**	
6 Minimally Invasive Therapies	*X*	**6 Funding Allocation Systems**	
7 Outcomes Research Tools		**7**	
8 Telemedicine	*XX*	**8**	
9			
10			
ADD YOUR OWN AREAS		**ADD YOUR OWN AREAS**	
Provide additional details about this new area(s):		**Provide additional details about this new area(s):**	

Table 3. TECHNOLOGY / POLICY MATRIX MAP

Team:	Consumers					
Issue Rank:	*1*	*2*	*3*	*4*	*5*	*6*
Legend ✷✷ = Main areas ✷ = Other related areas **Issues →**	*There is a general lack of access to the most recent and effective technologies in rural areas.*					
Technology Areas:						
1 Advanced Diagnostics	✷					
2 Assistive Technologies	✷					
3 Energy Delivery Devices						
4 Health Informatics	✷					
5 Microelectronics and Sensors	✷					
6 Minimally Invasive Therapies	✷					
7 Outcomes Research Tools						
8 Telemedicine	✷✷					
9						
10						
Technology-Specific Policy Areas:						
1 Legislative/Regulatory Reform/Improve						
2 Government Incentive Programs	✷					
3 Information Surety and Security						
4 Tort Liability Reform						
5 Metrics and Systems for Cost/Quality						
6 Funding Allocation Systems						
7						
8						

Table 4. GENERAL TECHNOLOGY AREA:	*TA8 - TELEMEDICINE*		
Vision of the future for the technology area: *Exploit information technologies to deliver medical services between locations.*			**Champions:**
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	• *Intra-organization applications*	• *Inter-organization applications*	• *Global applications*
Drivers:	• *Local area networks* • *Limited knowledge sharing* • *Intra-org. security*	• *Wide area networks* • *Partial knowledge sharing* • *Inter-org. security*	• *Global networks* • *Full, global knowledge sharing* • *Global security*
Sub-Technologies:	• *Communications* • *Computing*	• *Communications (mod. bandwidth, rate)* • *Computing (mod.res. video)*	• *Communications (high bandwidth, rate)* • *Computing (high res, storage, access)* • *Robotics devices*
Sponsoring Organizations:	• • •	• • •	• • •
Attributes:	• *Data rates ...* • *Line cost ...* • *Video resolution ...*	• • •	• • •

Session 7: Continue the Roadmapping exercise using the templates in Table 4. Tables are then reconfigured back to the original team designations.

Outbriefings: Players prepare a final briefing. Each team selects a spokesperson. Topics should cover: Team issues and objectives; Interfaces with others (collaborative, competitive, other); What was learned; and Conclusions. Each team will be allowed no more than 5 - 7 minutes for the presentation.

Wrap up and final polling: Players answer questions, fill out evaluation forms and sign-up for the roadmap follow-on efforts.

TEAM DESCRIPTIONS, CHALLENGES AND OPPORTUNITIES

Consumers:
The US health care system is vitally important to you and your family. You recognize that costs have been rising dramatically, but you want to preserve and improve the current system. You differ among yourselves in values. Some of you demand freedom to choose your own doctors; others are willing to sacrifice some choice in exchange for the lower costs provided from managed care. Some believe that health care is a universal right and entitlement; others that it is a commodity like food. Some of you enjoy stable employment, and employer-funded insurance. Others are elderly or poor. Many among you rely on government insurance programs and are concerned about the future benefits and costs of Medicare and Medicaid.

Challenges:

1. Select the best insurance options you can get.
2. When you become ill or disabled, seek the best medical treatment from the independent providers or the managed-care providers.
3. Do whatever you can as an individual to alter the health-care system by meeting with any of the other teams. Your private and tax dollars support this system. The trade-off between quality and cost of care is vitally important to you.
4. Consider forming a patient advocacy group to promote and defend your interests.
5. Investigate alternatives or improvements in employer-financed insurance.

Provider 1: Independent Physicians and Hospitals:
You are an independent physician, nurse, hospital employee, etc. You are dedicated to high quality care for your patients. You want to provide the best technology available today. However, rising costs are eating into profit margins, and creating conflicts with public and private insurers. You believe that the government is pushing you into more managed care systems to lower costs at the expense of quality and freedom of choice. You are interested in all aspects of the health care world. However, you are kept very busy maintaining your current practice. You would like to stay medically current and generally support new technologies. However, you need help in communicating with some scientists and engineers, and help with administrative and billing systems. You would like to reduce government red tape, reduce costs for malpractice insurance, and reduce the potential for making medical mistakes.

Challenges:

1. Provide appropriate care for the patients who come to you during the game.

2. Insure that you have access to the best available technologies at reasonable cost.
3. Negotiate with other providers to maintain quality and lower costs through collaboration and sharing of equipment, personnel, business practices, etc.
4. Support research on new technologies. Define areas in which technology can improve care and lower costs.
5. Meet with research funding organizations, universities, hospitals, suppliers and manufacturers to learn about new products and to suggest fruitful areas of additional research.
6. Lobby the insurers, legislators, etc. to help further your policies. Negotiate agreements.

Provider 2: HMOs, Managed-Care Systems:
You are a physician, nurse, hospital employee, etc., working in a managed-care facility. Most of you believe that your system is a good way to provide medical care at lower cost. You are dedicated to high-quality care for your patients. However, you believe that many diagnostic and treatment protocols are unnecessary and redundant. You also believe that the costs of new technologies can be kept under control by wise use and management practices. You have many ideas for reducing cost, but haven't had the time to develop them. This is your first opportunity to examine the potential of new technologies to lower cost and maintain or increase quality of care. Although still required to treat patients, you have decided to explore new technologies and new policies to advance your values. You are willing to try innovative experiments that may or may not succeed.

Challenges:
1. Provide appropriate care for the patients who come to you during the game.
2. Insure that you have access to the best available technologies at reasonable cost.
3. Negotiate with other providers to maintain quality and lower cost through collaboration and sharing of equipment, personnel, business practices, etc.
4. Support research on new technologies. Define areas in which technology can improve care and lower costs.
5. Meet with research funding organizations, universities, hospitals, suppliers and manufacturers to learn about new products and to suggest fruitful areas of additional research.
6. Lobby the insurers, legislators, etc. to help further your policies. Negotiate agreements.

Insurance Payers:
You represent private and public (Medicare, Medicaid) insurance organizations, and large companies that provide insurance. You are under great pressure to reduce costs. New technologies have generally resulted in increased costs, although the quality of care has been improved. Your resources are finite, and you must choose from available options. You would like to craft new policies for the public and private sectors that would be acceptable to the majority of patients, while not bankrupting the public or private systems. You are interested in new health care delivery processes, new technologies, methods for measuring costs and quality, collecting data, defining metrics, seeking alternatives to traditional medicine, home care, telemedicine, setting cost-performance goals, etc.

Challenges:

1. Beginning with the current system, begin to revise the private policies for future years, carefully weighing costs, benefits (covered and not covered treatments), pre-existing medical conditions, non-traditional medicine, etc.
2. Develop a revised system for public insurance (Medicare and Medicaid). Lobby the legislature to enact your new policies.
3. Meet with the lawyers to address concerns about malpractice insurance and ways to control costs.
4. Meet with providers to discuss your new policy recommendations.
5. Negotiate agreements with all other stakeholders to improve policies for technology development and usage.
6. Discuss cost shifting between the public and private sectors. Propose solutions.
7. Investigate technology systems and policies for reducing fraud and abuse, double charging, and unnecessary procedures and treatments (estimated to comprise 24% of health care expenditures).

Legislature:
The voters are very concerned about health care. So far, federal and state government attempts at reform have not met with success. Nevertheless, you wield enormous power for change for the better or for the worse. Revenues for the future are fixed; however, if savings are realized, they can be applied to other governmental programs or to reducing the national debt. You need to develop a list of requirements, assign priorities, and allocate future tax income. Creative solutions are encouraged. You should consider technology priorities, quality of life issues, time lines, and metrics to judge your progress. However, given the differing viewpoints among the voters, you must make a strong case for your proposals in order to be reelected.

Challenges:

1. Determine the allocation of resources to the various stakeholders and consumers in the medical community. Raise or lower the fraction of tax dollars devoted to health care.
2. Develop and pass new legislation dealing with the research, development, and introduction of new technologies.
3. Develop new policies in biomedical technologies.
4. State legislators review policies concerning professional certification, medical practice, financing, legal liabilities, regulation, and spending on health care. Innovate!
5. Discuss and debate values. Is medical care a right or a commodity like food? How important is quality of life in the cost vs benefit evaluation? Seek stakeholder inputs. Apply these values in proposed legislation.
6. Get reelected.
7. Develop an appropriate set of metrics to measure cost of care and new technologies in order to base legislation on reality; take future productivity of recovered patients into account.

Suppliers/Manufacturers:
You represent companies that make and sell biomedical devices and equipment. You have your own research facilities but are looking for joint ventures and partnerships with universities and national laboratories for additional R&D. You are concerned that new policies will limit the introduction and acceptance of new technologies.

Challenges:

1. Use your influence to change laws and regulatory practices.
2. Increase your profits.
3. Develop and sell new technologies.
4. Protect your interests by negotiating with other stakeholders.

US Food and Drug Administration and State Regulators:
Your agency oversees $350 billion worth of medical devices and radiation-emitting products. Overall, you oversee more than $1 trillion worth of products, which account for 25 cents of every dollar spent by American consumers. The new Congress is pressuring you to improve your procedures and policies. Many in the medical community believe that the FDA slows the introduction of new technologies, needlessly complicates the licensing procedures, and costs American jobs by sending manufacturers overseas. You have been trying to improve your regulatory processes, but the progress has been slow and painful. You have launched efforts to: exempt many categories of low-risk medical devices from premarket review, to harmonize FDA's drug and device testing requirements with other countries, and to introduce user fees. You have other initiatives underway. Other stakeholders in the medical community would like to work together with you to improve processes, shorten regulatory periods, exempt experimental technologies, and overall to improve the regulatory process. You have also been asked to prove (using data) that current procedures save more lives than are lost by delays.

Challenges:

1. Investigate the trade-offs between risks and benefits of the multi-year clinical trial period and streamline as appropriate.
2. Consider special rapid approvals for experimental technologies when the doctors and patients are willing to accept the risks.
3. Greatly speed up the regulatory process.
4. Reduce costs to inventors and developers of new technologies.
5. Meet with all stakeholders to negotiate tradeoffs on protection of intellectual property, lowering costs, reducing administrative burdens, while simultaneously protecting the health of the public.
6. Develop creative new approaches to regulation.
7. Determine the level of risk that the public is willing to accept and propose changes in policy or legislation based on the results.

Planning and Funding Organizations:
You represent the private and public organizations (including the Department of Defense, ARPA, National Science Foundation, The Koop Foundation, TheWhitaker Foundation, etc.) that provide resources to fund research and development of new biomedical technologies. There is great competition for scarce resources and your funding decisions must be based on potential impact, risks and uncertainties, and R&D costs.

Challenges:

1. Develop research areas and products that you would like to see explored; get input from health care providers, research institutions, your own needs, etc.
2. Seek funding from public and private sources; lobby the legislature.
3. Allocate resources to research institutions, etc. as appropriate; develop metrics to insure that the desired products are produced and that they deliver the promised results.

Universities/Laboratories:
Some of your laboratories have traditionally performed medical research. Others, like national laboratories, bring a new array of technology products that may have important applications in the medical field. These laboratories face both technical challenges and political issues concerning their contributions. Laboratory management is convinced that partnering in biomedical technologies will both assist the nation and the government in carrying out the labs' missions.

Challenges:

1. Determine the core competencies of each laboratory and institution, and develop procedures for collaboration and cooperation.
2. Determine the most fruitful areas of research to pursue, and who should pursue which area. Seek broad stakeholder input and support.
3. Define a set of research areas appropriate to each organization.
4. Seek funding to support this work.
5. Conduct the research (through probabilistic investments).
6. Negotiate with suppliers/manufacturers to transfer technology and market products.

Lawyers:
You resent the negative image that many people have of lawyers today. You believe that you protect the rights of patients against the "establishment." You also assist inventors in protecting their intellectual property and receiving the fruits of their work. You understand the legal system, and provide assistance to all parties in accomplishing their objectives.

Challenges:

1. As entrepreneurs, seek out customers and offer your assistance (for a fair price). Make a profit.
2. Lobby the legislature to protect your interests and profession.
3. Develop mediation/arbitration policies and systems to reduce litigation costs.
4. Develop and promote policies that improve the health care system (e.g., changes to tort law, malpractice cases, punitive damage caps, product liability claims, etc.).

DISEASE/DISABILITY CARDS

The D/D cards serve many functions in the game. They introduce the players to the important diseases and disabilities in the health care system, list the costs of conventional and advanced treatment options, estimate the costs to develop new technologies, illustrate probabilities of positive and negative patient outcomes and how these might improve with advanced technologies, and estimate the potential return on investment which is dominated by the ability of the consumer to return to the productive working population or to reduce the fiscal drain on the health care system. For individual patients, the following is a typical set of outcomes:

Outcome	Return on Investment
None (death or no change)	$0
Poor (invalid; unable to work)	-$20,000 per year for expected remaining lifetime
Partial (able to work part time)	+$10,000 per year until age 65
Complete (full recovery)	+$30,000 per year until age 65

These outcomes and returns are used for post-game analysis of the impact of technology on medical costs. However, they illustrate the potential benefits to society of returning patients to the work force or reducing costs for long-term care. For example, Figure 4 is a sample D/D card for "Diffuse Atherosclerosis." The estimated frequency of this condition is about 100,000 cases per year in the US. Currently available treatments include balloon angioplasties and bypass surgery. There is a significant probability of no change or death for both of these procedures. Furthermore, patients may be required to return for additional treatment or surgery in a few years, even if the surgery is successful. Option T33 is a laser device that completely removes atherosclerotic lesions (see Toolkit Option T33). This technology could reduce total treatment costs by a factor of five, and triple the probability of complete recovery for about eight years.

There are 32 D/D cards available in the game, as shown in Table 5. Twenty four of these apply to individual consumers (patients) and eight to the provider teams. Half of these patients are assumed to be privately insured through independent providers or HMOs. The other twelve are elderly, poor or military, and are insured by government programs (e.g., Medicare and Medicaid). All cards apply to either males or females, since the bill payers may be either regardless of the nature of the disease.

D/D cards 6, 7, 8, 21, 22, 25, 27, and 30 apply to the Provider teams. These cards focus on the potential benefits of diagnostics and prevention in the early detection of diseases (e.g., cancer screening). They also explore the process for adopting new procedures in a conservative HMO system, and the approach to dealing with major disasters.

Figure 5 shows provider card 6 - Breast Cancer Screening.

Table 5. D/D CARDS, INSURANCE TYPE, AND PATIENT DESCRIPTIONS

DD01	Private	Adverse Drug Reaction
DD02	Private	Diffuse Atherosclerosis
DD03	Gov.	Massive Battlefield Injuries
DD04	Private	Knee Osteoarthritis
DD05	Gov.	Blindness
DD06	Provider	Breast Cancer Screening
DD07	Provider	Cancer Screening Interpretation
DD08	Provider	Colon Cancer Screening
DD09	Private	Heart Replacement
DD10	Private	Insulin Dependent Diabetes Mellitus
DD11	Gov.	Hearing Loss
DD12	Gov.	Hip Fracture
DD13	Gov.	Home Bound Patient
DD14	Private	Ischemic Heart Disease Diagnosis
DD15	Private	Ischemic Heart Disease Treatment
DD16	Gov.	Kidney Failure

DD17	Gov.	Liver Replacement
DD18	Private	Lung Cancer
DD19	Private	Lung Replacement
DD20	Gov.	Medication Compliance/Monitoring
DD21	Provider	New Information Dissemination
DD22	Provider	New Procedure Adoption
DD23	Private	Paraplegic
DD24	Private	Premature Birth
DD25	Provider	Prostate Cancer Screening
DD26	Gov.	Quadriplegia
DD27	Provider	Skin Cancer Screening
DD28	Gov.	Tissue Diagnosis
DD29	Private	Unknown Critical Information
DD30	Provider	Disaster Evaluation and Triaging
DD31	Gov.	Burn debridement
DD32	Gov.	Threatened early delivery

Figure 4. Patient Disease/Disability Card

CARD 2	DIFFUSE ATHEROSCLEROSIS							FREQUENCY ~ 100,000/yr.	
45 year old, private insurance									
Patient:	A judge has familial hypercholesterolemia with symptomatic multi-vessel coronary artery disease, carotid,								
Doctor:	kidney and leg arterial lesions. Therapeutic interventions are needed.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Balloon angioplasties	$15,000	NA	None (death)	0.30	0.00-0.30	0		0	($15,000)
			Poor	0.35	0.31-0.65	1		($20,000)	($35,000)
			Partial	0.30	0.66-0.95	2		$10,000	$5,000
			Complete	0.05	0.96-1.00	3		$30,000	$75,000
Coronary arteries bypass surgery; carotid	$100,000	NA	None (death)	0.20	0.00-0.20	0		0	($100,000)
and abdominal surgery			Poor	0.30	0.21-0.50	2		($20,000)	($140,000)
			Partial	0.40	0.51-0.90	4		$10,000	($60,000)
			Complete	0.10	0.91-1.00	6		$30,000	$80,000
Not currently available	$20,000	$80M	None (death)	0.10	0.00-0.10	0		0	($20,000)
See option T33			Poor	0.20	0.11-0.30	3		($20,000)	($80,000)
			Partial	0.40	0.31-0.70	6		$10,000	$40,000
			Complete	0.30	0.71-1.00	8		$30,000	$220,000
Not currently available	$25,000	$120M	None (death)	0.05	0.00-0.05	0		0	($25,000)
See option T34			Poor	0.20	0.06-0.25	4		($20,000)	($105,000)
			Partial	0.35	0.26-0.60	8		$10,000	$55,000
			Complete	0.40	0.61-1.00	10		$30,000	$275,000
Not currently available	$25,000	$320M	None (death)	NA		0		0	NA
See option T9			Poor	0.10	0.00-0.10	5		($20,000)	($125,000)
			Partial	0.30	0.11-0.40	10		$10,000	$75,000
			Complete	0.60	0.41-1.00	15		$30,000	$425,000

Figure 5. Provider Team Disease/Disability Card

CARD 6	BREAST CANCER SCREENING							FREQUENCY ~ 10,000,000/yr.	
PROVIDER TEAM	In order to reduce mortality, breast cancer screening is vital. Average age 50.								
Team:									
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Continue current mammograms	$300	NA	None	0.20	0.00-0.20	5		0	($300)
			Poor	0.30	0.21-0.50	10		($20,000)	($200,300)
			Partial	0.30	0.51-0.80	15		$10,000	$149,700
			Complete	0.20	0.81-1.00	15	25	$30,000	$449,700
Not currently available	$300	$40M	None	0.10	0.00-0.10	5		0	($300)
See option T57			Poor	0.20	0.11-0.30	10		($20,000)	($200,300)
If T57 passes, you collect $100K			Partial	0.40	0.31-0.70	15		$10,000	$149,700
			Complete	0.30	0.71-1.00	15	25	$30,000	$449,700
Not currently available	$2,500	$180M	None	0.10	0.00-0.10	8		0	($2,500)
See option T15+T17			Poor	0.20	0.11-0.30	13		($20,000)	($262,500)
If T15+T17 passes, you collect $200K			Partial	0.20	0.31-0.50	15	18	$10,000	$147,500
			Complete	0.50	0.51-1.00	15	25	$30,000	$447,500
Not currently available	$600	$100M	None	0.03	0.00-0.03	10		0	($600)
See option T14			Poor	0.07	0.04-0.10	15		($20,000)	($300,600)
If T14 passes, you collect $300K			Partial	0.10	0.11-0.20	15	20	$10,000	$149,400
			Complete	0.80	0.21-1.00	15	25	$30,000	$449,400

The Provider teams will select four D/D cards at the start of Session 1. They are encouraged to discuss the treatment options and the potential benefits of new technologies. Over the course of the game, the Provider teams will receive income if any of the advanced technology options shown on their D/D cards succeed. The Providers can encourage others to make investments, or make their own investments inToolkit options or through the standard technology development process. Providers will receive payments in an ascending scale depending on the sophistication and benefits of the new technologies. No income is received for currently available options (labeled NA in the Technology Development Cost column). In the example of Figure 5, providers will receive $100,000 (green game dollars) if option T57 passes, $200,000 for options T15 and T17, and $300,000 for the last option, T14.

Measuring Quality Of Care:

In the game, quality of care will be subjectively measured by a short questionnaire supplied to the patients and their primary physicians. Each will answer the questions independently. Table 6 will be incorporated on the back side of each D/D card.

Detailed Process for Individual Patient D/D Cards

The process for handling D/D cards will proceed most smoothly if all players understand and execute their roles. Table 7 provides the step-by-step process for handling the D/D-Quality cards. Patients who "die" (or achieve no improvement) may not return to their original teams. They may go to the library reading table, attend legislative sessions, learn about health insurance by observing the Insurance Payers team, or otherwise silently observe other teams (in "ghost-like" fashion).

Measuring Cost Of Care

An algorithm will be developed that incorporates information from the disease/disability cards into estimates of costs as a function of time in the game. Costs will include initial treatment, hospital stay, other costs and return on investment. The cost to develop new technologies will also be included. This algorithm will be very simple. It is intended only to provide a rough qualitative estimate, and perhaps guide further, much more comprehensive econometric research. This will be done as part of the post-game analysis.

Table 6. EVALUATING THE QUALITY OF CARE

PATIENT'S (or PHYSICIAN'S) QUALITY CARD

Patient/Doctor: _____

Date: _____ Time: _____

Disease/Disability Card No.: _____

Please circle most appropriate rating:

1 = very bad 2 = bad 3 = neutral 4 = good 5 = very good

Cost was reasonable?	1	2	3	4	5
Treatment was efficient?	1	2	3	4	5
Treatment was appropriate?	1	2	3	4	5
Treatment option minimized risk?	1	2	3	4	5
Was technology adequate?	1	2	3	4	5
Did the treatment improve your quality of life?	1	2	3	4	5
Overall satisfaction:	1	2	3	4	5

Table 7. PROCEDURE FOR HANDLING AND COMPLETING D/D CARDS

D/D CARD PROCEDURES	
ACTION	**RESPONSIBLE PARTY**
1. Buy insurance policy from Insurers	Patient
2. Randomly select D/D card from Consumer Recorder	Patient
3. Go to Control (Cheryl) to get 2 copies of D/D cards and props.	Patient
4. Go to Provider Team (according to insurance) and meet with doctor to discuss treatment options. Decide on an option.	Patient, Doctor
5. Go to Insurance Team to get money for treatment. Return to Provider Team.	Patient, Insurers
6. Pay Provider Recorder full cost of treatment.	Patient, Recorder
7. Recorder takes money, pulls random number, and circles treatment outcome on both patient and doctor D/D cards	Recorder, Patient, Doctor
8. Patient and doctor fill out quality form, sign their D/D copies, and give both to Recorder who also signs and dates to verify completion.	Patient, Doctor, Recorder
9. "Dead" (or "no change") patients may not return to their team until the next session	Patient
10. Other patients may return to their teams and return props if they have sufficiently recovered.	Patient
11. If length of recovery is 1 or 2 years, patient and doctor must keep their D/D cards and return for follow-up treatment the next session.	Patient, Doctor, Recorder

TOOLKIT OPTIONS

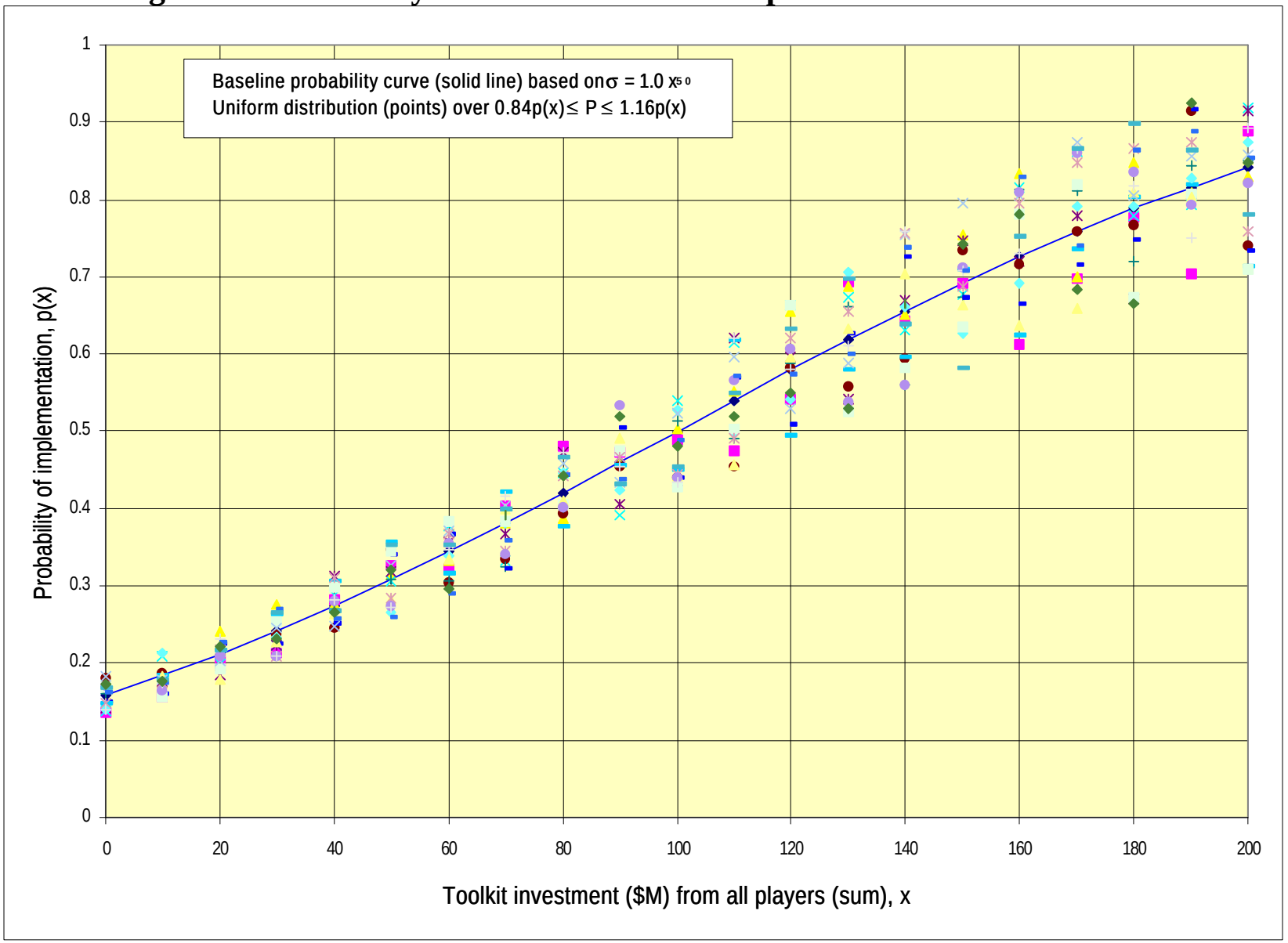
Players have two ways in which they can alter the future. One is the conventional approach that involves negotiations and contracts among the stakeholders in a realistic process that evolves within the game. The other way is through Toolkit Options. These are a list of technology and policy options that teams and players can invest in. We have created a list of these options and assigned a total resource investment that would yield a 50% probability of success. Teams determine which of these technology and policy options are important for their desired futures. Each team is given finite Toolkit resources. They invest their own resources and encourage others to partner with them, according to their priorities. Teams are also allowed to create their own Options. "Experts" on the Control team will assign mean investments that would yield a 50% probability of a successful outcome. All investments must be completed and turned into Control by the middle of Session 2. The results will be published at the start of Session 3. All successful technologies and policies will be implemented and become part of the environment of the game.

Toolkit Options provide an indication of some possible advances in technology, or policy changes that might significantly improve health care quality and lower costs. The Toolkit is a shortcut to accomplishing important objectives outside the normal highly expensive and time consuming processes. They are also meant to encourage collaboration among the many stakeholders and to indicate the highest priority technology and policy objectives of the players. Toolkit resources are not available for any other uses in the game. Investments made in unsuccessful options are permanently lost. *Toolkit investments are the responsibility of each team.* Each team must turn in its own Toolkit spreadsheet. The Toolkit options will also be posted on a wall board. Players are encouraged to enter their investments on the board, and observe the investment patterns of other teams. Since the board is unofficial, no team can hold another team liable for mistakes or investing differently from the board entries. However, formal agreements can be made between teams on investments (with Control's signature); violations of those written agreements can be litigated.

The outcomes of the Toolkit investments are determined probabilistically as shown in Figure 6. First, the baseline probability will increase with increasing investment following a normal distribution with mean x and standard deviation $\sigma = x$. Hence, an investment of twice the mean, $200M, would yield a success probability of 0.84. To take into account factors other than total investment, a uniform distribution is superimposed on the normal distribution to reflect uncertainties and risks in the real world for accomplishing major technology or policy breakthroughs. This uniform distribution can increase or decrease the baseline probability by as much as 16%. The total investments from all teams are fed into the computer and the success or failure is determined by this process. A list of technology and policy options is shown in detail in Appendix H.

The teams can invest up to the maximum allocations shown in Appendix H. Those resources represent the approximate dollars allocated (in millions) and relative influences of the different stakeholders. Toolkit dollars that are not invested are lost; they cannot be used in any other way in this game. Most of the Toolkit Options are linked directly with the D/D cards in Table 5 as shown in Appendix H.

Figure 6. Probability of Successful Toolkit Option for Cumulative Investments



MONEY - GAME DOLLARS

The function of money in the game is to introduce the concept of finite resources. This forces the players to create options and assign priorities that simulate real life. However, this game is complicated by the fact that it deals with individual patients and their treatments together with national issues related to government appropriations, research funding and performance, and overall industry income and outflow. A single currency definition cannot apply to all these situations and simultaneously provide the players with value measures that simulate reality. Hence, we have designed the following system to accommodate these diverse objectives. A discussion of the basis of our assumptions is provided in Appendix L.

All the bills circulating in the game are denominated in game dollars - $G. Game dollars come in two colors: green and yellow. Green dollars circulate primarily among the health delivery triad - consumers, providers, and insurers. Yellow dollars circulate *exclusively* within the national technology development system. For crossovers, conversion factors are printed on the bills. Table 8 illustrates the appropriate conversion factors.

Table 8. GAME DOLLARS COME IN TWO COLORS

Team	Dollar Type	Conversion for agreements, contracts
Consumers:	Green	$1 = $200
Provider 1: IPAs, individuals	Green	$1 = $200
Provider 2: HMOs	Green	$1 = $200
Insurance Payers:	Green	$1 = $200
Legislature	Green and Yellow	$1 = $1 for appropriations to health insurance $1 = $0.5 million for all other appropriations
Suppliers/Manufacturers	Yellow	$1 = $0.5 million
US FDA, Other Regulators	Yellow	$1 = $0.5 million
Planning/Funding Organizations	Yellow	$1 = $0.5 million
Universities/Laboratories	Yellow	$1 = $0.5 million
Lawyers	Green and Yellow	Depends on customer

Green dollars are used by consumers and insurers to pay for treatments and insurance policies (and any legal expenses related to an individual). If green dollars are used for any expense other than treatments (e.g., providers wishing to purchase products from suppliers or invest in research), each green dollar is worth $200.

Yellow dollars represent national expenses (research, manufacturing, etc.). In that environment, one game dollar represents $0.5 million. The two types of dollars allow the game to accurately estimate both the real costs to the patients for treatments and the real costs of research, developing, testing and manufacturing new technologies and products.

No money is allocated in Session 1. In Sessions 2-4, game dollars are allocated as shown in Table 9. Percentage entries in the 1996-7 column are estimated fractions of the total government health care outlay that went to different groups; the legislators can use these fractions as a guide for their future appropriations.

Table 9. TEAM AND PLAYER EXTERNAL INCOME PER SESSION

Team	1996-1997	1998-1999	2000-2001	2002-2003
Consumers: *Each player receives this amount.*		$45,000	$48,000	$52,000
Provider 1: IPAs, individuals				
Provider 2: HMOs				
Insurance Payers: Private States Medicare, Other Federal	 33.8% 64.7%	 TBA TBA	 TBA TBA	 TBA TBA
Legislature: Federal (66.2%) States (33.8%)		$180,000	$192,000	$208,000
Suppliers/Manufacturers		$800	$900	$1000
US FDA Other Regulators	0.1%	TBA	TBA	TBA
Planning/Funding Organizations Government (DoD, NSF, Koop, etc.) Private Foundations	 1.4%	 TBA $200	 TBA $200	 TBA $200
Universities/Laboratories				
Lawyers				

TBA: To be appropriated by the legislators

ADDITIONAL SPECIFIC TEAM INSTRUCTIONS

The game progression has been described in the section entitled "Playing the Game." All teams are expected to develop objectives and strategies to accomplish them, decide on Toolkit investments, etc. However, there are certain details that apply to specific teams. These are briefly discussed below.

Consumers:
The patients must divide evenly into private and government patients. The privately insured consumers can select insurance policies that apply to either the independent providers or the HMOs. The government patients may have only one policy to select. The sample policies are shown on the next three pages. Patients can discuss these policies with the Insurance team in Session 1, but they must purchase one policy within five minutes of the start of Session 2 (see below). Note that the Provider teams may initially compete for patients. However, in the event of a significant imbalance, the Control team will reassign patients. Patients receive their money from the recorder at the start of Session 2. After purchasing insurance, the patients will receive the D/D card assignment appropriate for their group (private or government) from the team recorder. They go to the Control team (Cheryl) to get two copies of the full D/D cards and related props, and follow the card instructions.

Provider Teams:
Provider Team 1 represents independent physicians and health care providers. Provider Team 2 represents HMOs. The Provider teams

have all the current resources listed on the D/D cards (those that have no associated technology development costs), as well as their own staff of physicians, nurses, etc. In the first session, the providers will organize themselves to compete or collaborate with each other, the insurance payer team, and other stakeholders. They must decide how patients will be handled in the later sessions. Tasks should be clear to all, as the arrival of patients will greatly stress the team's abilities. They should also discuss access to equipment, sharing versus owning, capital costs versus operating costs, etc. The providers should play their roles as they would in real life.

Insurance Payers:
The team should divide into three or four components to address the private and public patients and the independent and managed-care providers.

The following three sample policies (and the basis for them) are provided to the team. They may modify the policies, but there should not be more than two policies (HMO and independent) for each group of patients. Failure to complete the three or four policies will result in defaulting back to the samples.

The insurance payers can influence the future by creatively altering these policies as a result of negotiations with consumers, providers, the legislature, etc. Hence, the insurers are free to deliberate, and convey their thoughts through written policies.

Legislators:
Within realistic and practical constraints, legislators begin to decide how much federal money will be spent on Medicare/Medicaid and biomedical technology research in future years. They decide how the money is to be allocated and give patients and research institutions their fractions. All allocations must be completed and delivered prior to the applicable session. Failure to allocate funds will result in the Control team making appropriations.

Suppliers/Manufacturers:
Your team receives allocations that simulate income from the sale of pre-existing technologies. You may use this income to invest in new technologies, gain patent rights, conduct clinical trials, build facilities to manufacture new products, etc. Ultimately you will want to sell new products to the providers. You "win" the game by significantly growing your businesses.

FDA, State Regulators:
You play a crucial role in the game, as in real life. Explore creative solutions to reduce the time and costs required to bring new technologies to market. Consider ways to measure costs, benefits and risks of either excessive delays or inadequate testing. Consider different approaches to experimental treatments where both patients and providers are willing to accept higher than normal risks.

Planning/Funding Organizations:
Prioritizing research tasks has become a major policy issue in the US. Consider how much money is available and the best ways to spend it. Negotiate with all affected stakeholders.

Universities/National Laboratories:
National labs, research institutes and universities discuss their core competencies, develop partnerships with each other, with doctors, hospitals, suppliers, manufacturers, etc. Create strategies to develop new or improve existing technologies. Begin to seek funding from Congress, and other major biomedical funding and development organizations.

Option 1: Independent Medical Care Plan - Private

- You may choose any doctor or hospital for care
- You pay a deductible, $3000 per session
- Maximum out-of-pocket limit of $20000 per session
- The plan covers 80% of usual and customary charges, you pay the balance
- The plan pays 100% of usual and customary above the out-of-pocket limit
- Medical/surgical authorization must be obtained in advance from the Insurance team
- Experimental and education procedures not covered
- Routine preventive care not covered (physicals, etc.)

- Cost of insurance plan (1998) - $35000 for Session 2
- Estimated cost of insurance plan (2000) - $38000 for Session 3
- Estimated cost of insurance plan (2002) - $42000 for Session 4

Basis for numbers:

Estimated real consumer health care spending (1998,9) - $5830 per capita
Game allocation per consumer (1998,9) - $45000 (average cost per DD card)
Ratio of game dollars to estimated real dollars - 7.7

THUS, Deductible wascosted at 770% of two years worth of deductibles (~$400)
Stop-loss was estimated the same way
Average out-of-pocket costs for DD cards based on above - $10000 per card
THUS, Insurance cost set at $35000 for Session 2

Option 2: HMO Plan - Private

- You must use HMO doctors and facilities
- No deductible within the system
- Maximum out-of-pocket limit of $20000 per session (Session 2 only)
- $1000 copayment for Emergency Room hospitalization
- $500 copayment for radiation treatments or rehabilitation
- Medical equipment (wheelchairs, prostheses, etc.) covered at 20%
- Routine preventive care covered
- All care must be coordinated through primary care physician
- Some procedures/illnesses are not covered
  Organ transplants
  Experimental or educational procedures

- Cost of insurance plan (1998) - $32000 for Session 2
- Estimated cost of insurance plan (2000) - $35000 for Session 3
- Estimated cost of insurance plan (2002) - $39000 for Session 4
-

Basis for numbers:

Estimated real consumer health care spending (1998,9) - $5830 per capita
Game allocation per consumer (1998,9) - $45000 (average cost per DD card)
Ratio of game dollars to estimated real dollars - 7.7

THUS, Stop-loss wascosted at 770% of two years worth of stop-losses (~$2500)
Average out-of-pocket costs for DD cards based on above - $13000 per card
THUS, Insurance cost set at $32000 for Session 2

Option 3: Public Health Insurance - Government

- For GOVERNMENT PATIENTS ONLY - Money allocated by the legislature is available to supplement this policy.
- You may choose any doctor or hospital for care
- You pay a deductible, $3000 per session
- Maximum out-of-pocket limit of $20000 per session
- The plan covers 90% of usual and customary charges, you pay the balance. This includes hospitalization, rehab, educational assistance, home health visits, etc.
- The plan pays 100% of usual and customary above the out-of-pocket limit
- Based on age/condition, authorization may not be granted for some treatments.
- Experimental procedures not covered
- Routine preventive care not covered (physicals, etc.)

- Cost of insurance plan (1998) - $35000 for Session 2
- Estimated cost of insurance plan (2000) - $38000 for Session 3
- Estimated cost of insurance plan (2002) - $42000 for Session 4

Basis for numbers:

See notes for Option 1

Note to Payers:

Although the current Medicare system has parts A and B, the DD cards in the game are not structured to split hospital and physician costs. Therefore, in the above policy, the two are not separated as they should be. Please do not let this detract you from modifying the public health insurance in any way you feel is good and appropriate. The Prosperity Game directors will try to modify other parts of the game to help implement your changes into the game.

Lawyers:
Your team is the most unstructured in the game. Your contributions and accomplishments depend strongly on your own initiatives. How can the legal profession contribute to lowering costs for health care technology? Be creative; look for win-win solutions to the multitude of technology and policy issues.

RULES OF PLAY

CHARITY:

The game is not structured to handle charitable contributions outside the existing Medicaid and governmental provisions. All services must be paid for personally or through public or private insurance. Patients unable to pay for treatments cannot receive those treatments (except for emergency care). However, bankers are available (Control team) to discuss extenuating circumstances.

CONTRACTS:

Contracts or agreements can be carried out between any two or more teams. Contracts must describe an exchange of value for value. All contracts must use the standard form (see Figure 1) and be legibly written. A Control team member must be present at the formalization of any contract, which must be in writing; a member of the Control team must sign and date the agreement for it to be valid. If the success or failure of the contract is determined probabilistically, Control will perform the necessary calculations and report the results to the parties immediately. Success or failure will be determined by sampling from a normal distribution with the actual sum invested. For example, investing twice the median estimate will produce a probability of success of 84.1%; superimposed on this probability is another probability distribution that represents uncertainties and risks that are not necessarily reduced by larger investments.

DISPUTES:

All disputes will be resolved by the Control team, whose decisions are binding.

LAWSUITS:

Lawsuits can be filed at any time by any team. An odd number (at least 3) of judges must hear the case. After both sides have presented their arguments, the judges decide by majority rule. Judges' decisions are final and binding. Litigants must appear before the judges at their scheduled times. If one litigant is one minute late, a judgment will be immediately rendered in favor of the litigant who is present. If both litigants are five minutes late, the case will be dismissed; the litigants will need to reschedule their court times.

SCHEDULES, APPOINTMENTS

It is essential that all players strictly follow the agenda and be on time for their appointments. Penalties will be assessed for players or teams that are late.

NEW TOOLKIT OPTIONS

Teams or players who wish to create new options must follow these steps: 1. Write up option clearly; 2. Discuss it with a designated member of the Control team; if accepted, Control will assign a median success probability; 3. Provide all investors with written copies of the new option, together with the amount they will invest, and the signature of the team facilitator; 4. Bring option and investments to Control before deadline. Marketing of new options to other teams is the responsibility of the initiating team. New technology investments outside the Toolkit follow a similar process.

APPENDIX B: LIST OF PLAYERS AND STAFF

NAME	ADDRESS	PHONE #	FAX #	ROLE
CONSUMERS				
Bendicksen, Ms. Beverly, Director	Technology Ventures Corporation, 1155 University Blvd., SE, Albuquerque., NM 87106	505-843-4288	505-246-2891	
Bestgen, Dr. Robert, VP for Administration	The Lovelace Institutes, 2425 Ridgecrest Drive, Albuquerque, NM 87108-5127	505-262-7255	505-262-7043	
Boyce, Dr. Joe	Sandia National Laboratories, Emergency Medical Services, MS1018, P.O. Box 5800, Albuquerque, NM 87185-1018	505-844-4486	505-844-2608	
Gallegos, Joselyne	Sandia National Laboratories, MS0484, Org. 9415, Albuquerque, NM 87185-0484	505-845-8743	505-844-9524	
Haas, Amy	SNL, MS0431, Org. 9400, Alb. NM 87185-0431	505-844-2699	505-844-2716	Logistics
Middleton, Dr. Blackford, VP, Clinical Systems	MedicaLogic, 15400 NW Greenbriar Parkway, Suite 400, Beaverton, OR 97006	503-531-7000	503-531-7001	
Padilla, Gil	Presbyterian Hospital, Biomedical Technical Services, P.O. Box 26666, Albuquerque, NM 87125-6666	505-841-1159	505-841-1951	
Yonas, Dr. Gerry, VP, Information and Pulse Power Res. & Tech. Division	Sandia National Laboratories, MS0151, P.O. Box 5800, Albuquerque, NM 87185-0151	505-845-9820	505-844-6307	
Garcia, Marie	SNL, MS0127, Org. 4501, Alb. NM 87185-0127	505-844-9444	505-844-1218	Facilit/Analyst
Shaw, Gladys	SNL, MS1379, Org. 4500, Alb. NM 87185-0131	505-284-2421	505-844-0619	Recorder
PROVIDERS 1: INDEPENDENTS				
Bennahum, Dr. David	UNM Dept. of Medicine, ACC5, Alb. NM 87131	505-272-6082	505-272-1754	
Boom, Dr. Ried	500 Tanglewood, Manchester, IA 52057	319-927-6960	319-927-5247	
Franken, Dr. Edmund, Professor of Radiology	University of Iowa, College of Medicine, 200 Hawkins Drive, Iowa City, IA 52242	319-356-3391	319-356-2220	
Hart, Dr. Blaine, UNM Dean's Science Advisory Council	Dept. of Radiology, UNM Health Center, 915 Camino Salud NE, Alb. NM 87131	505-272-2269	505-277-5821	
Horvath, Dr. Andrew, Sr. VP	Presbyterian Healthcare Services, P.O. Box 26666, Albuquerque, NM 87125-6666	505-841-1442	505-841-1861	
Rattner, Dr. David, Director, Center for Innovative Minimally Invasive Therapy	Massachusetts General Hospital, ACC337, 32 Fruit Street, Boston, MA 02114	617-726-1893	617-726-0355	
Re, Dr. Richard, VP & Director of Research	Alton Ochsner Medical Foundation, 1516 Jefferson Highway, New Orleans, LA 70121	504-842-3135	504-842-3899	
VanDevender, Dr. J. Pace, Director, National Industrial Alliances Center	SNL, MS1180, Org. 4700, Alb. NM 87185-1180	505-844-5148	505-844-5163	Facilit/Analyst

Schoeneman, Paula	SNL, MS0339,Org. 1880, Alb. NM 87185-0339	505-845-8543	505-844-9126	Recorder
PROVIDERS-2: HMOs				
Alverson, Dr. Dale, Clinical Director	Professor of Pediatrics & OB/GYN, University of NM School of Medicine, Albuquerque, NM 87131	505-272-3967	505-272-6845	
Davila, Dr. Fidel	Scott & White Clinic, Dept. of Medicine, 2401 South 31st Street, Temple, TX 76508	817-724-2377	817-724-4899	
Gollub, Dr. Roger	Albuquerque Area Indian Health Service, 505 Marquette Avenue, NW, Albuquerque, NM 87102	505-248-5427	505-248-5441	
Gray, Dr. David	Washington University School of Medicine, 4444 Forrest Park, St. Louis, MO 63108	314-286-1600	314-286-1601	
Krousel-Wood, Dr. Marie	Alton Ochsner Medical Foundation, 1516 Jefferson Highway, New Orleans, LA 70121	504-842-3562	504-842-3899	
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Schroeder, Dr. Don	SNL, MS0985,Org. 2605, Alb. NM 87185-0985	505-845-8409	505-844-5916	Facilit/Analyst
Nenninger, Connie	SNL, MS0127,Org. 12670, Alb. NM 87185-0127	505-844-2146	505-844-1218	Recorder
INSURANCE PAYERS				
McCoy, Dr. Mike	UCLA, 10880 Wilshire Blvd, Suite 300, Los Angeles, CA 90024	310-825-9459	310-206-5396	
Moorman, Flora Jane, Assistant to the President	P.O. Box 13547, #15 Alexander Drive, Research Triangle Park, NC 27709	919-541-9366	919-990-9544	
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Allen, Dr. George	SNL, MS0756,Org. 6651, Alb. NM 87185-0756	505-844-9769	505-844-0968	Facilitator
Cloer, Bryon	SNL, MS0449,Org. 9403, Alb. NM 87185-0449	505-844-6069	505-844-2927	Analyst/Rec.
LEGISLATORS				
Billy, Ms Carrie, Legislative Assistant for Jeff Bingaman	4316 Marionet St, Alexandria VA 22312	703-354-5327	202-224-2852	
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	Avenue NW, #816, Washington DC 20008-3733			
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Tichenor, Suzy, VP	Council on Competitiveness, 1401 H Street NW, Suite 650, Washington DC 20005	202-682-4292	202-682-5150	
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Officer				
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PLANNING/FUNDING ORGANIZATIONS				
Fouke, Janie, Division Director	National Science Foundation, Div. of Bioengineering & Env. Systems, 4201 Wilson Blvd., Rm. 565, Arlington, VA 22230	703-306-1320	703-306-0312	
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Wiesmann, Colonel William	Combat Casualty Care Research Program, U.S. Army Medical Research & Material Command, Attn: MCMR-PLB, Fort Detrick, Frederick, MD 21702-5012	301-619-7591	301-619-7067	
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UNIVERSITIES/NATIONAL LABS				
Felton, Dr. Robert	University of California at Los Angeles, 9420 Reseda Boulevard, Suite 504, Northridge, CA 91324	818-902-2305	818-349-2558	
Hansen, Dr. Robert (Jack), Chief Scientist, Associate Director	Applied Research Laboatory, Penn State University, PO Office Box 30, State College, PA 16804-0030	814-865-1419	814-863-0673	
Piland, Dr. Neill, Director, Institute for Health & Population Research	The Lovelace Institutes, 2425 Ridgecrest Drive, SE, Albuquerque, NM 87108	505-262-7312	505-262-7598	
Mort, Dr. Elizabeth, Director of Quality Measurement, Clinical Care Mgmt Unit	Massachusetts General Hospital, 50 Stanford St. 9th Floor, Boston, MA 02114	617-726-4106	617-726-4120	
Varnado, Dr. Sam, Director, Information Systems Engineering Center	Sandia National Laboratories, MS0431, P.O. Box 5800, Albuquerque, NM 8718509431	505-845-9555	505-844-2716	

Warner, Dr. Dave, Director	Institute for Interventional Informatics, 24985 Lawton Avenue, Loma Linda, CA 92354	909-799-3000	909-799-6106	
Zink, Dr. Sandra, Program Manager, Biosciences	Los Alamos National Labs, P.O. Box 1663, MS D-455, Los Alamos, NM 87545	505-667-5260	505-665-9154	
Bray, Olin	SNL, MS0127, Org. 4501, Alb. NM 87185-0127	505-845-8636	505-844-1218	Facilitator
Miller, Dr. A. Keith	Manager/Special Projects, SNL, MS0309, Org. 9818, Alb. NM 87185-0309	505-845-8812	505-844-0094	Analyst/Rec.
LAWYERS				
Gilbert, Francoise, Attorney at Law	Altheimer & Gray, 10 South Wacker Drive, Suite 4000, Chicago, IL 60606	312-715-4984	312-715-4800	
Granade, Phyllis, Attorney at Law	Kilpatrick & Cody, 1100 Peachtree Street, Atlanta, GA 30309-4530	404-815-6032	404-815-6555	
Guthrie, Marvin, VP, Patents, Licensing & Industry Sponsored Research	Massachusetts General Hospital, 13th Street, Bldg. 149, Suite 1101, Charlestown, MA 02129	617-726-2128	617-726-1668	
Marks, Richard, Attorney at Law & Partner	Dow, Lohnes & Albertson, 1255 23rd Street NW, Suite 500, Washington, DC 20037	202-857-2565	202-857-2900	
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Boom, Kristi	SNL, MS0954, Org. 2903, Alb. NM 87185-0954	505-844-2814	505-844-5422	Facilitator
Garcia, Victoria, Attorney-at-Law	51 Tierra Madre Rd, Placitas, NM 87043	505-243-3799	505-243-6475	Analyst/Rec.
CONTROL TEAM				
Berman, Dr. Marshall	SNL, MS1151, Org. 4701, Alb. NM 87185-1151	505-845-3141	505-845-3668	Game Director
Boyack, Dr. Kevin	SNL, MS1151, Org. 4701, Alb. NM 87185-1151	505-845-3183	505-845-3668	Co-Game Director
Wesenberg, Dr. Don	SNL, MS0449, Org. 9403, Alb. NM 87185-0449	505-845-0194	505-844-2927	Finance, patents, etc.
Mitchell, Cheryl L.	SNL, MS1151, Org. 4701, Alb. NM 87185-1151	505-845-3035	505-845-3668	D/D cards, money
Gurule, Adrian	SNL, MS1359, Org. 12911, Alb. NM 87185-1359	505-271-7048	505-271-7956	Computing, Tools
Miller, Chris	SNL, MS0167, Org. 12621, Alb. NM 87185-12621	505-844-5550	505-844-6367	News media
Shepherd, Gary	SNL, MS1090, Org. 13411, Alb. NM 87185-1090	505-845-8078	505-844-3075	Radio broadcasting

APPENDIX C: GAME SCHEDULE

Wednesday, November 1, 1995

5:00 pm Participant registration and badging; collect materials.

5:30 pm Players gather in Conference Center; get acquainted with team members. "Hello" process; go to assigned tables.

6:00 pm Welcome: Sam Varnado, J. Pace VanDevender.

6:15 pm Dinner with your team members.

7:00 pm Prosperity Game briefing/overview with questions and answers; polling (Marshall Berman -- Game Director)

8:00 pm Formal meeting adjourned. Private team meetings and discussions may begin.

Thursday, November 2, 1995

7:30 am Continental Breakfast

SESSION 1 - January 1, 1996:

8:00 am Morning "Hellos." Players go to assigned tables.

8:15 am Facilitators lead teams in initial assignments:

All teams Set ground rules for deliberation, decision-making, etc. Develop game, team and personal objectives and strategies to meet the challenges. Define the different roles appropriate to your team and which players will represent each role: Insurance Payers (Medicare/Medicaid, private companies); Legislators (Federal, State); FDA, Regulators (FDA, state agencies); Planning/Funding Organizations (private foundations, DoD, NSF, Koop, etc.); Suppliers (represent several companies, a single consortium, etc.); Universities/Laboratories (universities, research hospitals, national labs, etc.); Lawyers (patent attorneys, malpractice specialists, etc.). Develop strategies to meet the challenges defined in the Players' Handbook; begin to implement those strategies. Prepare Toolkit Investments. Make appointments with other teams to begin preliminary negotiations.

Consumers Voluntarily or by lot, divide into two even groups: private consumers and government consumers (elderly, poor, or military). Similarly, the private and public consumers should individually consider the insurance coverage. Get the corresponding 1998 insurance policies from the Insurer team.

Providers Decide on roles (doctor and specialty, nurse, administrator, etc.), teaming, sharing equipment capital and operating costs. Divide up work and begin play. Review the Disease/Disability (D/D) cards in preparation for Session 2. Discuss the provider-specific D/D cards.

Insurance Payers Review current policy options with consumers. Begin to develop innovative policy concepts for the future.

10:00 am ***Consumer Recorder gives 1998 money to each consumer***

10:10 am ***Consumers complete purchase of insurance policies.***
Legislators complete 1998 appropriations; Recorder disburses money.
Control (Cheryl) disburses money to Suppliers/Manufacturers and Private Foundations.

10:15 am Break

SESSION 2 - January 1, 1998:

10:30 am Radio news broadcast.

10:35 am Patients receive D/D cards numbers from Consumer Recorder; go to Control team (Cheryl) to get D/D cards and props; follow directions for medical treatment.

11:30 am ***Complete all Toolkit investments and submit only your own team's options to Control team. No furtherToolkit investments are allowed after 11:30 am.***

12:00 pm Lunch

12:05 pm Radio news broadcast.

SESSION 3 - January 1, 2000:

1:00 pm ***Consumer Recorder gives 2000 money to each consumer***

1:15 pm ***Consumers complete purchase of 2000 insurance policies.***
Legislators complete 2000 appropriations; Recorder disburses money.
Control (Cheryl) disburses money to Suppliers/Manufacturers and Private Foundations.

1:30 pm SuccessfulToolkit investments are announced and implemented.

1:35 pm Patients receive new D/D card numbers from Consumer Recorder (unless their previous disease requires them to continue treatment); go to Control team (Cheryl) to get D/D cards and props; follow directions for medical treatment.
Other teams continue deliberations and negotiations.

2:55 pm Radio news broadcast.

SESSION 4 - January 1, 2002:

3:00 pm ***Consumer Recorder gives 2002 money to each consumer***

3:15 pm ***Consumers complete purchase of 2002 insurance policies. Legislators complete 2002 appropriations; Recorder disburses money. Control (Cheryl) disburses money to Suppliers/Manufacturers and Private Foundations.***

3:30 pm Successful technologies and policies that have been negotiated among the teams are announced and implemented into the game.

3:35 pm Patients receive new D/D card numbers from Consumer Recorder (unless their previous disease requires them to continue treatment); go to Control team (Cheryl) to get D/D cards and props; follow directions for medical treatment. Other teams continue deliberations and negotiations.

4:55 pm Final radio broadcast.

5:00 pm End of day's activities.

5:30 pm Banquet dinner.

6:15 pm Dinner speaker: Dr. Richard Re, Alton Ochsner Medical Foundation.

7:00 pm Adjourn

Friday, November 3, 1995

7:30 am Continental Breakfast

SESSION 5 - Identify Problems and Solution Areas by Team

8:00 am Teams identify issues, problems, challenges and potential solutions.

9:00 am Map issues onto technology and policy solution areas. Define new solution areas if necessary. Prioritize issues and select most important one. Select spokesperson to present and discuss the key issue.

9:30 am Issue Debriefing - Plenary Session: The most important technology and policy issues faced by the nation. Five minutes for each team. Innovator polling to determine preference for technology and policy areas.

10:30 am Break. Team tables relabeled. Technology/Policy Area matrix maps copied and placed on tables.

SESSION 6 -Roadmapping Technologies and Policies

10:45 am Players reassemble by technology and policy areas in which they are interested. (Tables will berelabeled.) Groups review issue-area matrix maps to assimilate cross-cuts. Technology groups define vision, applications/objectives, drivers, sub-technologies, and sponsoring organizations for their areas. Policy groups refine solutions and explore related strategies, tactics, positives, negatives, and costs.

12:30 pm Working Lunch

12:45 - 1:00 Dr. Steve Dawson, Massachusetts General Hospital.

SESSION 7 -Roadmapping continued

1:30 pm Continue the exercise from Session 6. Groups should be into detailed discussions and explorations.***Complete all inputs by 3:00pm.***

3:00 pm Break. End of Session 7. Players return to original team tables.

3:15 pm Teams prepare final briefing on the entire game; select spokesperson.

3:45 pm Team debriefings; no more than 5-7 minutes each.

4:45 pm Wrap up; final polling;ifll out evaluation forms; sign up forroadmap effort.

5:00 pm Game adjourned.

APPENDIX D: AGREEMENTS AND CONTRACTS

AGREEMENTS AND CONTRACTS							
				SUCCESS/FAILURE			
				(if necessary)			
Description of Contract/Agreement	**"Customer" (Paying)**	**"Supplier" Team**	**Time**	**Funds transfer**	**50% cost**	**Proba-bility**	**Success or failure**
New policytoolkit option P11 - The legislature will fund/provide balanced meals and immunizations for all needy children. Annual funding from at $20M from HC	Legislature	Control	8:57 AM		$30M		
New policytoolkit option P12 - Given that technology option 'T1 - Secureinternet HC info system' passes, FDA will have access to all necessary information to investigate incidents and evaluate post-marketing	FDA	Control	10:02 AM		$30M		
Six year contract to provide total health care services at $1800 per member per month. Insurers to assume marketing function. Providers to report specific outcomes data. Negotiable fee for transplants and	Insurers	Provider 2: HMO	10:33 AM	$1800 (G) pmpm			
Toolkit: Consumers commit $105M in T4, insurers commit $70M in T7. Insurers will also commit $30M in	Consumers	Insurers	10:45 AM				
Toolkit: HMO commits $30M and Funders commit	Funders	Provider 2:	11:22				
Providers and insurers jointly invest to market regionally dispersed delivery systems and education. Physicians provide majority access and quality control and assume full risk except for reinsurance. 10% premium to insurers.	Insurers	Provider 1: Independents	11:28 AM				
Provider agrees to accept 50% now and 50% two years later from insurers for care of Ms. Amy Haas.	Insurers	Provider 1: Independen	11:39 AM	$70K (G)			
Retainer to advise and lobby legislature for insurance reform. Providers seek relief from need for insurance	Providers 1: Independent	Lawyers	11:59 AM	$10K ( )			

$100M antitrust lawsuit filed by Mr. Robert Shives against the insurance industry in the California Central	Lawyers: Rob Shives	Insurers	12:03 PM				
Providers agree to accept $10K cash for $20K liability for services rendered to Ms. Amy Haas. Amy (now a quadriplegic) agrees to help market provider services	Consumers: Amy Haas	Providers 1: Independen	12:07 PM	$10K (G)			
Univ/Labs have identified gaps in the NII - nationwide low cost communications infrastructure doesn't exist and surety/bandwidth do not meet minimum requirements. Legislature funds this work at Univ/Labs ($100M)	Legislature	Univ/Labs through Funders	1:20 PM	$100M (Y)			
Innovative Health Products, Inc., invests in technology T25 (secure system for linking provider to home).	Suppliers	Control	1:31 PM	$60M (Y)	$40M	0.64	Success
Innovative Health Products, Inc., invests in technology T17 (advanced image algorithms for screening).	Suppliers	Control	1:31 PM	$90M (Y)	$60M	0.77	Success
Suppliers agree to pay attorneys per attached schedule for representation in patent applications for T25 and T17	Suppliers	Lawyers		$100K ( )			
Insurers contract with legislature to accept only $100K of $174K appropriation, thus accruing savings to US treasury (based on four federal patients). Legislature	Insurers	Legislature	1:38 PM	$74K (G)			
Consumer Joe Boyce is self-insured and gives $5K ($1M in research) for research of Coronary Artery Disease to	Consumers: Joe Boyce	Provider 1: Independen	1:45 PM	$5K (G)			
Attorney will draft and present patent application for supplier group on (T24, T26, T27) home health unit.	Suppliers	Lawyers	1:47 PM	$35K ( )			
Retainer to represent Providers 1 in lawsuit for pump failure.	Providers 1: Independent	Lawyers		$25K (G)			
Settlement in personal injury case - defective device approved by FDA. Plaintiff precluded from any future	Provider 1: Independent	Customers	2:00 PM	$80K (G)			
Investment in technology T14 (microwave screening system).	Funders thru Univ/Labs	Control	2:04 PM	$200M (Y)	$100M	0.90	Success
Investment in technology T47 (xenogeneic heart).	Funders thru Univ/Labs	Control	2:16 PM	$600M (Y)	$300M	0.80	Success

Suppliers ($300M) and Univ/Labs ($600M) jointly fund T49 (tissue cultured organs/cells). Univ/Labs do work; Univ gets 10% of net profits; Funders get 50% of net	Suppliers & Funders thru Univ/Labs	Control	2:19 PM	$900M (Y)	$600M	0.71	Success
Patent attachment to T49.		Lawyers		$60K ( )			
Establish 'Healthcare Information & Communication Alliance' to provide certification. 501(c)3. Membership funded. To develop national stds for info/data exchange. To enable consumer decisions. One member from each	Providers 1 Insurers Suppliers Funders		2:22 PM	$1M (Y) $4M (X) seed money			
Joint development of end-to-end usability and user testing for insurance-specific information communication system. Profits/ licensing to be shared 50/50.	Insurers Univ/Labs	Control	2:23 PM	$1M (Y) $1M (X)	$1M	0.94	Success
Streamlined process for phase I, II, III testing of new technology. Univ/Labs provide rapid prototyping equipment for test/analysis; Providers 1 (exclusive) do clinical evaluations at 5% over cost; Suppliers and FDA/Legislature provide matching funds.	FDA Legislature Suppliers Univ/Labs Providers 1		2:34 PM	$348M (Y) $2M (X) seed money			
Retainer between supplies and lawyers of $500K to be drawn against for future patents at the scheduled rate.	Suppliers	Lawyers		$500K (Y)			
Suppliers manufacturing costs: $5M non-invasive telemed device; $30M organ growth.	Suppliers	Control		$35M (Y)			
Supplier agrees to the following steps regarding T49. Non-clinical trials, clinical study development, conduct and evaluation of results, application for approval. An	Suppliers	FDA	2:56 PM	$500K (Y)	$250K	0.97	Success
Suppliers will develop (50/50 cost split) a computer-guided energy delivery (incl. microwave, RF, focused ultrasound) device for selective tumor destruction (T10 mod). $1.5M device cost, $7.5K treatment cost. 10%	Suppliers Funders	Control	2:59 PM	$200M (Y)	$200M	0.50	Failure
New User Facility Test Lab established at a National Lab. Providers 1 will supply evaluators to assist lab team. Test lab will let vendors evaluate their products. Labs help train small clinics/ hospitals in use of medical informatics.	Univ/Labs Providers 1	Control	3:01 PM	$19M (Y) $1M (X)	$10M	0.94	Success

Retainer for settlement of antitrust suit.	Insurers	Lawyers	3:02 PM	$20K (G)			
Settlement of antitrust suit. Insurers to pay $50K this year, $50K in two years, plus apology.	Insurers	Customers	3:02 PM	$100K (G)			
10:33 AM agreement between Insurers and Providers 2 cancelled.	Insurers	Providers 2:	3:08 PM				
Proprietary patient information system to be computer accessed by patients at home through AOL. Plan to charge a per access fee of $1. Estimated market of 5M	Providers 1: Independents	Control	3:13 PM	$2M (X)	$1M	1.00	Success
Second try on T10 mod. Funders royalty increased to 20%.	Suppliers Funders	Control	3:17 PM	$200M (Y)	$200M	0.58	Success
Attorney agrees to file and prosecute patent application for T14. License agreement to also be negotiated. Fees	Univ/Labs	Lawyers		$30K ( )			
Development of a communication system for low cost home-based communication between high risk invalids	Univ/Labs	Control	3:27 PM	$5M (Y)	$2M	0.92	Success
Provider 2 will provide full medical benefits including preventive, screening, diagnostic and therapeutic services (no transplants or experimental) for $38,000/session 4 to	Customers	Providers 2: HMO	3:28 PM	$38K (G) per person			
Development of risk analysis technology using pattern recognition to identify matrices of high risk at the community level. Upon identification, risk reduction measures are exercised, with resulting 4:1 ROI in form of	Funders Providers 1	Control	3:30 PM	$45M (Y) $45M (X)	$45M	1.00	Success
Identification of genetic markers for breast, colon and lung cancers, and development of tests to reliably screen	Funders thru Univ/Labs	Control	3:32 PM	$120M (Y)	$60M	0.90	Failure
Complaint: Patient vs. Provider 1. Medical device failure causing one week hospital stay, near death, emotional distress requiring psychiatric treatment.							
Home Health Care Unit (T17+T25) approval process: nurse performs noninvasive diagnostic, data processed by software, results transmitted to doctor bytelelink. System is classified 510(k). Supplier pays user fees of	Suppliers	FDA (for approval) Univ/Labs (trials)	3:36 PM	$100K ( ) $200K ( )			

Development of Physician Group Management Software (PGMS) which will link physicians, institutes, library, database, etc. using user-friendly easy access module.	Provider 1: Independents	Control	3:46 PM	$5M (X)			
1998, 2000 and 2002 appropriations to FDA for $90M, $90M and $104M are considered as FDA operational budget. Additional $13.5M in 1998 was inadequate for P8 funding as designated, was not spent, and is drawing	FDA	Legislature	3:52 PM				
$12K additional rider to cover organ transplant for remainder of insurance period.	Customers: Joe Boyce	Providers 2:					
Exclusive HMO communication system developed, designed and implemented in one year. Access to physicians, satellite offices, patients. Hardware, software and interface development, web and database access.	Providers 2: HMO Univ/Labs		4:00 PM	$7.5M (G) $2.5M (Y)			
Second attempt for identification and screening tests of genetic markers for breast, colon and lung cancers. Suppliers gain 85% of profits through this current round	Suppliers thru Univ/Labs	Control	4:03 PM	$30M (Y)	$60M	0.81	Success
Under the National Disability Protection Technology Program, HMO and Labs provide financial support for R&D of long-life ultra-reliable wheelchair batteries and lightweight compact life support systems for wheelchair	Providers 2: HMO Univ/Labs	Control	4:03 PM	$20M (G) $16M (Y)	$25M	0.76	Success
Retainer for initial HCFA inquiry, state insurance matters and representation at the legislative hearing. If matter escalates, additional fees will be charged.	Insurers	Lawyers	4:05 PM	$35K (G)			
Establish $1B Center of Excellence for development of Assistive and Rehab Technology that will improve quality of life and independence and prevent secondary disability. Proposals for use of the funding are encouraged.	Funders		4:05 PM	$1B (Y) set aside			
Establish $1B Center of Excellence to develop technologies to reduce injuries and mitigate morbidity	Funders		4:05 PM	$1B (Y) set aside			

Establish $1B Center of Excellence to enhance health through genetic diagnoses for inherited and acquired diseases and in-vivo gene therapy treatments for these disorders (incl. metabolic, inflammatory, toxin-related	Funders		4:05 PM	$1B (Y) set aside			
Establish $1B Center of Excellence to develop anxiety/depression screening tests and technology-based	Funders		4:05 PM	$1B (Y) set aside			
Establish $1B Center of Excellence to develop infrastructure and technology-base care options for	Funders		4:05 PM	$1B (Y) set aside			
FDA purchases $600K in hardware/software upgrades.	FDA	Suppliers	4:12 PM	$600K			
Attorney to file and prosecute patent on T47 for	Univ/Labs	Lawyers		$40K ( )			
Providers 1 alleges exclusive rights to T49. Providers 2 is providing T49 to patients, and retains an attorney to represent in a potential (not yet filed) complex lawsuit by	Providers 2: HMO	Lawyers		$50K (G)			
Suppliers pay attorneys to pursue a lawsuit against Provider 2 for patent infringement (on T49?).	Suppliers	Lawyers		$300K ( )			
Voice-activated emergency communications and bioelectric pickup developed for wheelchair patients at the Univ/Labs.	Providers 2 Consumers Univ/Labs	Control	4:25 PM	$5M (G) $5M (G)	$5M	1.00	Success
Provider 1 conducts clinical trials for T14 (microwave sensor). Marketing plan to be negotiated with suppliers	Suppliers	Control	4:25 PM	$3M (Y)	$1M	0.93	Failure
Second attempt: Provider 1 conducts clinical trials for T14 (microwave sensor).	Suppliers	Control	4:26 PM	$0.5M (Y)	$1M	0.81	Success
FDA 510(k) approval of a radiofrequency device for minimally invasive cancer treatment (T10 mod).	Suppliers	FDA	4:30 PM	$150K (Y)	$50K	1.00	Success
Development of online curriculum for the education of the Admin. and other government decision makers. Includes interventional informatics, telemedicine-related materials, decision support technology and distributed	Univ/Labs			$1.5M (Y)			
R&D focused in the following areas: acoustic screening (incl. portable), information security (next gen. encryption), patient education (improved elderly	Funders	Univ/Labs	4:40 PM	$250M (Y)	$150M	0.89	Success

PMA for FDA approval for genetic markers and cancer	Univ/Labs		4:40 PM	$250K (	$250K	0.45	Success
Lawsuit: Suppliers and Providers 1 sue Providers 2 for patent infringement on T49. Damages sought $5.7B.			4:42 PM				
Using the NII, Univ/Labs will develop a 'virtual' Center of Excellence for Assistive and Rehab Technologies that will coordinate research efforts nationwide (lab, university, industry). Includes beta site with equipment based on	Funders	Univ/Labs	4:45 PM	$1B (Y) previously set aside			
FDA will pursue educational outreach in 21 districts for suppliers, universities, labs on how to better navigate	FDA		4:46 PM	$500K (Y)			
PMA for FDA approval for T14 (microwave screening)	Suppliers	Univ/Labs	4:48 PM	$500K	$250K	0.92	Success
Test effectiveness of a patient report card assessment method to measure preventive lifestyle behavior. Followed by educational intervention to get patient buy-in. Reevaluate after 6 months and compare to control	Providers 1: Independents	Control	4:48 PM	$100K (G)	$50K	0.95	Success
Funders committing $600M to health system coordination technology. GIS technology used to map need and service delivery on a national basis. Develop algorithms for identifying mismatches and recommending	Funders thru Univ/Labs	Control	4:52 PM	$600M (Y)	$250M	0.98	Success
Complaint: Since Provider 2 has acted in violation of state insurance laws, it has received improperly the consumers' premiums. Insurers file suit for damages to recover rightful administrative costs and profits as if they			5:00 PM				
UNOFFICIAL (thus questionable) AGREEMENTS							
Insurers and Providers update 10:33 AM agreement to $1875 pmpm. No signatures.							

Univ/Labs to develop an RF minimally invasive cancer therapy device. Providers 1 conduct clinical trials, submit to FDA. Device consists of standard RF generator, monopolar probe to deliver energy to affected regions.	Suppliers	Providers 1 Univ/Labs		$100? ( ) to Labs $105K (			
Due to recent Dept. of Justice decision, original government health insurance is reinstated, along with originally scheduled $208K in appropriations. No	Insurers Legislature						

APPENDIX E: NEWS RELEASES

PRESS RELEASE

The heads of state and federal regulators, including the Department of Justice and the Federal Trade Commission, have expressed considerable concern over relationships among competing providers which may run afoul of antitrust laws.

Several such arrangements are presently under investigation by the Department of Justice and the Federal Trade Commission.

NEW RELEASE

11/2/95 - 9:20 AM
Innovative Health Products, Inc.

IHP has been formed from a group of established companies to provide a broad range of innovative health products and services. Constituent companies focus on screening, diagnosis, monitoring, informatics andtelemedicine and other innovative treatment strategies. IHP actively seeks interested parties in partnering to create improved products and services.

IHP is open to proposals from any organization interested in working with them.

Tim Taylor, IHP
(Suppliers)

FDA PUBLIC ANNOUNCEMENT

11/2/95 -11:15 am

The FDA would like to announce its initiatives to work with the Legislatures, Suppliers, National Labs and funding organizations to work on the implementation of policies to expedite the approval of safe and effective technologies. This will be accomplished by encouraging collaboration between those participating in the R&D process.
In addition, the agency has taken a pro-active public health stance in advocating policies to improve technology related to the communication of information to the agency.

To the above-stated ends, the FDA will be making the following major resource commitment of $30 million on medical device product development accreditation process, P8, $30 million devoted to reducing the review and approval time by 75%, P9. In addition, $10 million will be devoted to grassroots collaborative effort with industries, P6, and $10 million in seed money to develop a national secure and confidential Internet utility for communication of patient safety information, P12.

PRESS RELEASE

A consortium of R&D funders has committed $45 million to the following activities:

T14 - portable cancer screening
T35 - artificial cartilage
T42 - medication dispenser; providers committed $30M, $15M is still needed

These moneys will be committed if matching funds are found to bring these technologies to 50% probability of success.

The R&D funders are also now accepting unsolicited proposals. Those who commit funds in the toolkit round will be considered more favorably in next round of funding.

PUBLIC ANNOUNCEMENT BY BARBARA WHITE, FDA

11/2/95 - 11:40 am

Preliminary review of toolkit funding suggests that lack of support for P6, P8, P9 and P12 will prevent the FDA from streamlining the review and approval process to ensure good public health.

PRESS RELEASE

11/2/95 - 1:45 pm
1-1-2000

U.S. Funding Organizations Initiating New Funding Opportunities, Research Possibilities

United States funding organizations have announced they are initiating new areas of opportunities and research. The organizations hope to see supportive, integrative and developmental technologies that can enhance health care by,

1) Stimulating the use of gene product diagnoses for inherited and acquired genetic diseases.
2) Developing enabling technologies and enhancing development of in-vivo gene therapies for treatment of inherited and acquired genetic disorders, including metabolic diseases, inflammatory diseases and othe genetic disorders and defects related to toxins.

The funding organizations also announced they are seeking request for proposals for policies or legislative programs that limit the tort liability of manufacturers of raw materials that are used in the fabrication of devices that are ultimately implanted within the body. The organizations also are looking for innovative programs to address remaining toolkit issues, specifically T14, T17, T47, T49, and P1. Congress has provided generous funding for new biotechnology programs for health care.

PRESS RELEASE

11/2/95 - 2:05pm
1-1-2000

Insurers announce third health-care option

Complementing its high-value care offerings, insurers are proud to announce its "government-care" option, which complements the HMO and health network products introduced previously.

HMOs still underutilized, insurers say

HMOs are still underutilized by consumers, according to a new study released by insurers. Most consumers still do not understand the range of medic, education, and other services offered today, the study indicates. A chief advantage of HMOs, insurers say, are their lower costs.

NEWS RELEASE

11/2/95 - 3:30pm
June 6, 2002

Philanthropist announces desire to fund worthy health-care projects

BlackfordMiddleton has announced a desire to provide funds from a personal fund to support the research and development of knowledge engineering tools, expert systems and other technologies to support improved clinical decision making in the health care field.

Middleton said he has about $100 million available. Persons or organizations seeking funds are encouraged to focus on the above areas, to share costs wherever possible, and to make the results publicly available.

Middleton recently was almost killed when an implanted medication delivery device malfunctioned. He said he hopes to use the proceeds of his successful lawsuit to improve health care for all U.S. citizens.

Middleton can be reached at the Consumer table.

FDA: New Technology Testing & Reimbursement

11/2/95
Signed by PresidentBerman at 3:32pm

I. The Federal Food, Drug & Cosmetic Act is amended to add the following new section:
A) New Device Approval:Using current length of time for new technology review within the FDA as a benchmark, the FDA shall:

1) Revise existing regulations, rules and procedures, and

2) Implement new regulations and procedures that will:

a) With respect to "Pre-marketing Approval Devices" (PMAs"), result in a reduction in the time period for new technology review within the FDA 25 percent;

b) With respect to section 510(k) devices ("substantially equivalent devices"), result in a reduction in the time period for new technology review within the FDA of 40 percent.

B) Reporting Requirements: Within 90 days of enactment of this Act, the Commissioner shall report to the Congress on proposed regulatory and procedural changes.

C) Post-Marketing Surveillance: Using existing outcomes data bases, the FDA shall devote increased resources to post-market review of medical devices to ensure maximum public safety and quality of life.

II. New Technology Reimbursement. The Social Security Act of 1965 is amended as follows:

A) Fundings: Congress has determined that it is cost-beneficial and that it expands access to potentially beneficial new medical devices to require reimbursement under the Medicare program for certain investigational medical devices that have received Investigational Device Exemptions (IDEs) from the FDA for clinical trials in designated health care facilities. Such medical devices should include, in particular, those life-threatening and otherwise highly debilitating conditions for which any existing technologies are inadequate.

B) Secretary's Report: Within 90 days of enactment of this act, the Secretary shall report to the Congress on:

(1) The cost impact of permitting pre-approval reimbursement for medical devices that have received Investigational Device Exemptions; and

(2) Recommendations for expanding Medicare reimbursement of investigational medical devices.

APPENDIX F: D/D CARDS

CARD 1	ADVERSE DRUG REACTION					FREQUENCY ~ 20K/yr.			
55 year old, private insurance									
Patient:	A senior vice president for marketing has a day surgery urologic procedure and medications are ordered.								
Doctor:	A severe drug reaction to a known (but overlooked) allergy occurs. The patient requires 3 weeks of								
Recorder:	hospitalization for recovery. A review of the incident is undertaken.								
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Accept these events as unavoidable	$30,000	0	None (death)	0.02	0.00-0.02	1		($1,000,000)	($1,030,000)
Productivity includes legal costs/fees			Poor	0.08	0.03-0.10	10	15	($20,000)	($330,000)
			Partial	0.15	0.11-0.25	10	15	$10,000	$70,000
			Complete	0.75	0.26-1.00	10	15	$30,000	$270,000
Not currently available	$30,000	$50E+06	None (death)	0		1		0	$0
See option T2			Poor	0.02	0.00-0.02	10	15	($20,000)	($330,000)
			Partial	0.03	0.03-0.05	10	15	$10,000	$70,000
			Complete	0.95	0.06-1.00	10	15	$30,000	$270,000
Not currently available	$30,000	$70E+06	None (death)	0		1		0	$0
See option T3			Poor	0.01	0.00-0.01	10	15	($20,000)	($330,000)
			Partial	0.02	0.02-0.03	10	15	$10,000	$70,000
			Complete	0.97	0.04-1.00	10	15	$30,000	$270,000
Not currently available	$30,000	$110E+06	None (death)	0		1		0	$0
See option T4			Poor	0		10	15	($20,000)	$0
			Partial	0		10	15	$10,000	$0
			Complete	1	0.00-1.00	10	15	$30,000	$270,000

CARD 2	DIFFUSE ATHEROSCLEROSIS					FREQUENCY ~ 500K/yr.			
45 year old, private insurance									
Patient:	A judge has familial hypercholesterolemia with symptomatic multi-vessel coronary artery disease, carotid,								
Doctor:	kidney and leg arterial lesions. Therapeutic interventions are needed.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Balloon angioplasties	$15,000	$0	None (death)	0.30	0.00-0.30	1		0	($15,000)
			Poor	0.35	0.31-0.65	1		($20,000)	($35,000)
			Partial	0.30	0.66-0.95	2		$10,000	$5,000
			Complete	0.05	0.96-1.00	3		$30,000	$75,000
Coronary arteries bypass surgery; carotid	$100,000	$0	None (death)	0.20	0.00-0.20	1		0	($100,000)
and abdominal surgery			Poor	0.30	0.21-0.50	2		($20,000)	($140,000)
			Partial	0.40	0.51-0.90	4		$10,000	($60,000)
			Complete	0.10	0.91-1.00	6		$30,000	$80,000
Not currently available	$20,000	$80E+06	None (death)	0.10	0.00-0.10	1		0	($20,000)
See option T33			Poor	0.20	0.11-0.30	3		($20,000)	($80,000)
			Partial	0.40	0.31-0.70	6		$10,000	$40,000
			Complete	0.30	0.71-1.00	8		$30,000	$220,000
Not currently available	$25,000	$120E+06	None (death)	0.05	0.00-0.05	1		0	($25,000)
See option T34			Poor	0.20	0.06-0.25	4		($20,000)	($105,000)
			Partial	0.35	0.26-0.60	8		$10,000	$55,000
			Complete	0.40	0.61-1.00	10		$30,000	$275,000
Not currently available	$25,000	$320E+06	None (death)	0.00		1		0	$0
See option T9			Poor	0.10	0.00-0.10	5		($20,000)	($125,000)
			Partial	0.30	0.11-0.40	10		$10,000	$75,000
			Complete	0.60	0.41-1.00	15		$30,000	$425,000

CARD 3	MASSIVE BATTLEFIELD INJURIES								FREQUENCY ~ 10,000/yr.
25 year old, government insurance									
Patient:	Several soldiers are wounded by a bomb in battle. Most have massive internal injuries and bleeding and are								
Doctor:	in shock with almost no vital signs. The nearest field hospital is more than 1 hour away.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Field first aid, then	$800	$0	None (death)	0.80	0.00-0.80	0		0	($800)
transport to field hospital			Poor	0.10	0.81-0.90	40	50	($20,000)	($1,000,800)
			Partial	0.05	0.91-0.95	40	50	$10,000	$399,200
			Complete	0.05	0.96-1.00	40	50	$30,000	$1,199,200
Not currently available	$6,000	$120E+06	None (death)	0.30	0.00-0.30	0		0	($6,000)
See option T21+T22			Poor	0.30	0.31-0.60	40	50	($20,000)	($1,006,000)
			Partial	0.20	0.61-0.80	40	50	$10,000	$394,000
			Complete	0.20	0.81-1.00	40	50	$30,000	$1,194,000
Not currently available	$7,500	$140E+06	None (death)	0.10	0.00-0.10	0		0	($7,500)
See option T21+T23			Poor	0.20	0.11-0.30	40	50	($20,000)	($1,007,500)
			Partial	0.20	0.31-0.50	40	50	$10,000	$392,500
			Complete	0.50	0.51-1.00	40	50	$30,000	$1,192,500
Not currently available	$9,000	$180E+06	None (death)	0.05	0.00-0.05	0		0	($9,000)
See option T21+T22+T23			Poor	0.15	0.06-0.20	40	50	($20,000)	($1,009,000)
			Partial	0.20	0.21-0.40	40	50	$10,000	$391,000
			Complete	0.60	0.41-1.00	40	50	$30,000	$1,191,000

CARD 4	KNEE OSTEOARTHRITIS								FREQUENCY ~ 100,000/yr.
50 year old, private insurance									
Patient:	Due to heavy work, osteoarthritis of the knees has become a severe problem in late middle age for many people.								
Doctor:									
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Wait and do artificial	$5,000	$0	No change	0.10	0.00-0.10	5		($20,000)	($105,000)
knee implants			Little change	0.40	0.11-0.50	10		($20,000)	($205,000)
			Partial	0.40	0.51-0.90	15		$10,000	$145,000
			Complete	0.10	0.91-1.00	15	20	$30,000	$445,000
Insert knee joint	$15,000	$0	No change	0.05	0.00-0.05	5		($20,000)	($115,000)
cushions now			Little change	0.20	0.06-0.25	15		($20,000)	($315,000)
			Partial	0.35	0.26-0.60	15	25	$10,000	$135,000
			Complete	0.40	0.61-1.00	15	25	$30,000	$435,000
Not currently available	$6,000	$70E+06	No change	0.01	0.00-0.01	5		($20,000)	($106,000)
See option T35			Little change	0.09	0.02-0.10	15	20	($20,000)	($406,000)
			Partial	0.20	0.11-0.30	15	25	$10,000	$144,000
			Complete	0.70	0.31-1.00	15	25	$30,000	$444,000

CARD 5	BLINDNESS							FREQUENCY ~ 10,000/yr.	
25 year old, government insurance									
Patient:	A youth with no private insurance has an accident with severe damage to both eyes. After recovery only								
Doctor:	poor light perception is present. Glasses provide no improvement of vision.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Surgery	$10,000	$0	None	0.70	0.00-0.70	5		($10,000)	($60,000)
			Poor	0.30	0.71-1.00	10		($10,000)	($110,000)
			Partial	0.00		NA		$10,000	NA
			Complete	0.00		NA		$30,000	NA
Artificial eye parts	$20,000	$0	None	0.40	0.00-0.40	5		($10,000)	($70,000)
			Poor	0.40	0.41-0.80	10		($10,000)	($120,000)
			Partial	0.20	0.81-1.00	20		$10,000	$180,000
			Complete	0.00		NA		$30,000	NA
Not currently available	$30,000	$80E+06	None	0.20	0.00-0.20	5		($10,000)	($80,000)
See option T36			Poor	0.30	0.21-0.50	10		($10,000)	($130,000)
			Partial	0.30	0.51-0.80	20		$10,000	$170,000
			Complete	0.20	0.81-1.00	30		$30,000	$870,000
Not currently available	$50,000	$180E+06	None	0.10	0.00-0.10	5		($10,000)	($100,000)
See option T37			Poor	0.20	0.11-0.30	10		($10,000)	($150,000)
			Partial	0.40	0.31-0.70	40		$10,000	$350,000
			Complete	0.30	0.71-1.00	40	50	$30,000	$1,150,000

CARD 6	BREAST CANCER SCREENING							FREQUENCY ~ 10M-20M/yr.	
PROVIDER TEAM									
	In order to reduce mortality, breast cancer screening is vital. Average age 50.								
Team: INDEPENDENTS									
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Continue current mammograms	$300	$0	None	0.20	0.00-0.20	5		0	($300)
			Poor	0.30	0.21-0.50	10		($20,000)	($200,300)
			Partial	0.30	0.51-0.80	15		$10,000	$149,700
			Complete	0.20	0.81-1.00	15	25	$30,000	$449,700
Mobile cancer screening units at	$300	$40E+06	None	0.10	0.00-0.10	5		0	($300)
patients' locations			Poor	0.20	0.11-0.30	10		($20,000)	($200,300)
			Partial	0.40	0.31-0.70	15		$10,000	$149,700
			Complete	0.30	0.71-1.00	15	25	$30,000	$449,700
Non-invasive scan and advanced image	$2,500	$180E+06	None	0.10	0.00-0.10	8		0	($2,500)
diagnostic screen			Poor	0.20	0.11-0.30	13		($20,000)	($262,500)
			Partial	0.20	0.31-0.50	15	18	$10,000	$147,500
			Complete	0.50	0.51-1.00	15	25	$30,000	$447,500
Portable quick microwave screen	$600	$100E+06	None	0.03	0.00-0.03	10		0	($600)
			Poor	0.07	0.04-0.10	15		($20,000)	($300,600)
			Partial	0.10	0.11-0.20	15	20	$10,000	$149,400
			Complete	0.80	0.21-1.00	15	25	$30,000	$449,400

CARD 7	CANCER SCREENING INTERPRETATION			FREQUENCY ~ 13M-40M/yr.					
PROVIDER TEAM									
	Cancer marker testing has identified large groups of patients that require frequent imaging for cancer screening.								
Team: INDEPENDENTS	Using two shifts and weekends, the screening equipment and personnel are available but physician/interpreters								
Recorder:	are not. Something needs to be done.								
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Hire more physicians	$300	NA	None	0.01	0.00-0.01			0	($300)
for interpretations			Poor	0.02	0.02-0.03			($20,000)	($20,300)
			Partial	0.03	0.04-0.06			$10,000	$9,700
			Complete	0.94	0.07-1.00			$30,000	$29,700
Not currently available	$300	$30E+06	None	0.02	0.00-0.02			0	($300)
See option T16			Poor	0.04	0.03-0.06			($20,000)	($20,300)
If T16 passes, you collect $100K			Partial	0.05	0.07-0.11			$10,000	$9,700
			Complete	0.89	0.12-1.00			$30,000	$29,700
Not currently available	$400	$60E+06	None	0				0	NA
See option T17			Poor	0				($20,000)	NA
If T17 passes, you collect $200K			Partial	0.02	0.00-0.02			$10,000	$9,600
			Complete	0.98	0.03-1.00			$30,000	$29,600

CARD 8	COLON CANCER SCREENING			FREQUENCY ~ 1M-10M/yr.					
PROVIDER TEAM									
	A genetic screening test has just identified a large group that is a high risk for colon cancer. Current imaging								
Team: HMO	studies do not detect this cancer early. Regular colonoscopy is required. Average patient age is 50.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Hire more physicians for	$600	$0	None	0.10	0.00-0.10	3		$0	($600)
colonoscopies			Poor	0.30	0.11-0.40	6		($20,000)	($120,600)
			Partial	0.40	0.41-0.80	12		$10,000	$119,400
			Complete	0.20	0.81-1.00	15	25	$30,000	$449,400
Not currently available	$1,600	$150E+06	None	0.05	0.00-0.05	6		$0	($1,600)
See options T15+T16			Poor	0.10	0.06-0.15	9		($20,000)	($181,600)
If T15+T16 passes, you collect $100K			Partial	0.25	0.16-0.40	15		$10,000	$148,400
			Complete	0.60	0.41-1.00	15	25	$30,000	$448,400
Not currently available	$2,300	$180E+06	None	0.01	0.00-0.01	12		$0	$0
See options T15+T17			Poor	0.04	0.02-0.05	15	17	($20,000)	($340,000)
If T15+T17 passes, you collect $200K			Partial	0.05	0.06-0.10	15	23	$10,000	$150,000
			Complete	0.90	0.11-1.00	15	25	$30,000	$450,000

CARD 9	HEART REPLACEMENT								FREQUENCY ~ 10K-100K/yr.
35 year old, private insurance									
Patient:	A professional is found to have a severe idiopathic dilated cardiomyopathy. Medical management has failed.								
Doctor:	A new heart is needed.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Allogeneic heart transplant	$50,000	$0	None (death)	0.20	0.00-0.20	0		0	($50,000)
with life-long drugs			Poor	0.40	0.21-0.60	5		($20,000)	($150,000)
			Partial	0.30	0.61-0.90	15		$10,000	$100,000
			Complete	0.10	0.91-1.00	25		$30,000	$700,000
Not currently available	$50,000	$300E+06	None (death)	0.10	0.00-0.10	0		0	($50,000)
See option T47			Poor	0.20	0.11-0.30	8		($20,000)	($210,000)
			Partial	0.40	0.31-0.70	18		$10,000	$130,000
			Complete	0.30	0.71-1.00	28		$30,000	$790,000
Not currently available	$50,000	$250E+06	None (death)	0.05	0.00-0.05	0		0	($50,000)
See option T48			Poor	0.15	0.06-0.20	5		($20,000)	($150,000)
			Partial	0.30	0.21-0.50	15		$10,000	$100,000
			Complete	0.50	0.51-1.00	20		$30,000	$550,000
Not currently available	$75,000	$600E+06	None (death)	0.00		0		0	NA
See option T49			Poor	0.00		0		($20,000)	NA
			Partial	0.10	0.00-0.10	30	35	$10,000	$225,000
			Complete	0.90	0.11-1.00	30	40	$30,000	$825,000

CARD 10	INSULIN-DEPENDENT DIABETES MELLITUS								FREQUENCY ~ 500K new/yr.
20 year old, private insurance									
Patient:	A teen-ager presents to the hospital with signs and symptoms of diabetic								
Doctor:	ketoacidosis. After treatment, Type 1 (insulin-Dependent) diabetes mellitus is diagnosed.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Insulin injections with daily glucose	$4,000	$0	None	0.10	0.00-0.10	2		($20,000)	($44,000)
monitoring			Poor	0.20	0.11-0.30	15		($20,000)	($304,000)
Note: Productivity includes 2K/yr insulin cost			Partial	0.30	0.31-0.60	20		$8,000	$156,000
			Complete	0.40	0.61-1.00	25		$28,000	$696,000
External pump with glucose sensor	$10,000	$10E+06	None	0.05	0.00-0.05	2		($20,000)	($50,000)
control of insulin dose			Poor	0.15	0.06-0.20	20		($20,000)	($410,000)
Note: Productivity includes 2K/yr insulin cost			Partial	0.35	0.21-0.55	30		$8,000	$230,000
			Complete	0.45	0.56-1.00	40		$28,000	$1,110,000
Not currently available	$20,000	$160E+06	None	0.03	0.00-0.03	2		($20,000)	($60,000)
See option T50			Poor	0.07	0.04-0.10	20		($20,000)	($420,000)
Note: Productivity includes 2K/yr insulin cost			Partial	0.10	0.11-0.20	40		$8,000	$300,000
			Complete	0.80	0.21-1.00	50		$28,000	$1,380,000
Not currently available	$40,000	$200E+06	None	0.01	0.00-0.01	2		($20,000)	($80,000)
See option T49			Poor	0.03	0.02-0.04	30		($20,000)	($640,000)
			Partial	0.06	0.05-0.10	50		$10,000	$460,000
			Complete	0.90	0.11-1.00	50	60	$30,000	$1,460,000

CARD 11	HEARING LOSS								FREQUENCY ~ 10,000/yr.
20 year old, government insurance									
Patient:	A 20 yr old on welfare suffers complete hearing loss after spinal meningitis (infection.)								
Doctor:									
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Sign language/lip reading	$50,000	$0	None	0.05	0.00-0.05	45	55	($10,000)	($400,000)
			Poor	0.45	0.06-0.50	45	55	$10,000	$500,000
			Partial	0.45	0.51-0.95	45	55	$10,000	$500,000
			Complete	0.05	0.96-1.00	45	55	$30,000	$1,600,000
Not currently available	$75,000	$70E+06	None	0.10	0.00-0.10	45	55	($10,000)	($425,000)
See option T38			Poor	0.20	0.11-0.30	45	55	$10,000	$475,000
			Partial	0.60	0.31-0.90	45	55	$10,000	$475,000
			Complete	0.10	0.91-1.00	45	55	$30,000	$1,575,000
Not currently available	$100,000	$200E+06	None	0.00		45	55	($10,000)	NA
See option T39			Poor	0.05	0.00-0.05	45	55	$10,000	$450,000
			Partial	0.15	0.06-0.20	45	55	$10,000	$450,000
			Complete	0.80	0.21-1.00	45	55	$30,000	$1,550,000

CARD 12	HIP FRACTURE								FREQUENCY ~ 300K/yr.
70 year old, government insurance									
Patient:	An elderly patient falls off a horse and fractures a hip. Surgery is required.								
Doctor:									
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Standard 30-yr hip	$45,000	$0	None (death)	0.10	0.00-0.10	0		0	($45,000)
replacement and rehab			Poor	0.20	0.11-0.30	10	5	($20,000)	($245,000)
			Partial	0.30	0.31-0.60	10	5	($10,000)	($145,000)
			Complete	0.40	0.61-1.00	10	5	($5,000)	($95,000)
Min. invasive hip fracture banding and	$25,000	$75E+06	None (death)	0.03	0.00-0.03	0		0	($25,000)
artificial bone cementing			Poor	0.07	0.04-0.10	10	5	($20,000)	($225,000)
			Partial	0.20	0.11-0.30	10	5	($10,000)	($125,000)
			Complete	0.70	0.31-1.00	10	5	($5,000)	($75,000)
Not currently available	$45,000	$110E+06	None (death)	0.05	0.00-0.05	0		0	($45,000)
See option T40			Poor	0.10	0.06-0.15	10	5	($20,000)	($245,000)
			Partial	0.25	0.16-0.40	10	5	($10,000)	($145,000)
			Complete	0.60	0.41-1.00	10	5	($5,000)	($95,000)

CARD 13	HOME BOUND PATIENT								FREQUENCY ~ 1M-3M/yr.
65 year old, government insurance									
Patient:	A home bound patient has no transportation to the health center. Regular and urgent access to health care is								
Doctor:	needed to optimally manage the existing medical conditions.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Use government paid transportation	$10,000	$0	None (death)	0.10	0.00-0.10	0		$0	($5,000)
Note: treatment costs per session			Poor	0.30	0.11-0.40	10	20	($20,000)	($400,000)
			Partial	0.30	0.41-0.70	10	20	($10,000)	($100,000)
			Complete	0.30	0.71-1.00	10	20	($5,000)	($50,000)
Home health visits	$10,000	$0	None (death)	0.10	0.00-0.10	0		$0	($5,000)
Note: treatment costs per session			Poor	0.15	0.11-0.25	10	20	($20,000)	($400,000)
			Partial	0.35	0.26-0.60	10	20	($10,000)	($100,000)
			Complete	0.40	0.61-1.00	10	20	($5,000)	($50,000)
Not currently available	$2,000	$20E+06	None (death)	0.05	0.00-0.05	0		$0	($1,000)
See option T24			Poor	0.10	0.06-0.15	10	20	($20,000)	($400,000)
Note: treatment costs per session			Partial	0.35	0.16-0.50	10	20	($10,000)	($100,000)
			Complete	0.50	0.51-1.00	10	20	($5,000)	($50,000)
Not currently available	$4,000	$40E+06	None (death)	0.02	0.00-0.02	0		$0	($2,000)
See option T25			Poor	0.08	0.03-0.10	10	20	($20,000)	($400,000)
Note: treatment costs per session			Partial	0.20	0.11-0.30	10	20	($10,000)	($100,000)
			Complete	0.70	0.31-1.00	10	20	($5,000)	($50,000)

CARD 14	ISCHEMIC HEART DISEASE DIAGNOSIS								FREQUENCY ~ 2.1M/yr.
60 year old, private insurance									
Patient:	An engineer presents with severe, chest pain typical for heart disease Several risk factors for coronary								
Doctor:	artery disease are present. Diagnostic testing is needed.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Non-invasive stress	$800	NA		0.20	0.00-0.20				
testing				0.20	0.21-0.40				
				0.30	0.41-0.70				
				0.30	0.71-1.00				
Invasive angiography	$5,000	NA		0.10	0.00-0.10				
				0.20	0.11-0.30				
				0.30	0.31-0.60				
				0.40	0.61-1.00				
Not currently available	$10,000	$80E+06		0.05	0.00-0.05				
See option T19				0.10	0.06-0.15				
				0.25	0.16-0.40				
				0.60	0.41-1.00				
Not currently available	$6,000	$350E+06		0.02	0.00-0.02				
See option T20				0.05	0.03-0.07				
				0.13	0.08-0.20				
				0.80	0.21-1.00				

CARD 15	ISCHEMIC HEART DISEASE TREATMENT							FREQUENCY ~ 1M/yr.
55 year old, private insurance								
Patient:	A lawyer with known multi-vessel coronary artery disease has failed medical management. A therapeutic							
Doctor:	intervention is needed.							
Recorder:								
Date/Time:								

Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Balloon angioplasties	$15,000	$0	None (death)	0.15	0.00-0.15	0		$0	($15,000)
			Poor	0.30	0.16-0.45	1		($20,000)	($35,000)
			Partial	0.40	0.46-0.85	2		$10,000	$5,000
			Complete	0.15	0.86-1.00	3		$30,000	$75,000
Coronary arteries by-	$25,000	$0	None (death)	0.10	0.00-0.10	0		$0	($25,000)
pass surgery			Poor	0.20	0.11-0.30	3		($20,000)	($85,000)
			Partial	0.50	0.31-0.80	6		$10,000	$35,000
			Complete	0.20	0.81-1.00	9		$30,000	$245,000
Not currently available	$50,000	$80E+06	None (death)	0.05	0.00-0.05	0		$0	($50,000)
See option T33			Poor	0.10	0.06-0.15	4		($20,000)	($130,000)
			Partial	0.40	0.16-0.55	8		$10,000	$30,000
			Complete	0.45	0.56-1.00	12		$30,000	$310,000
Not currently available	$20,000	$320E+06	None (death)	0.02	0.00-0.02	0		$0	($20,000)
See option T9			Poor	0.08	0.03-0.10	5		($20,000)	($120,000)
			Partial	0.30	0.11-0.40	10		$10,000	$80,000
			Complete	0.60	0.41-1.00	15		$30,000	$430,000

CARD 16	KIDNEY FAILURE							FREQUENCY ~ 120K/yr.
30 year old, government insurance								
Patient:	Treatment of severe battlefield trauma results in return to normal function except for irreversible kidney							
Doctor:	failure. Transplantation is not possible. Life-long treatment will be needed.							
Recorder:								
Date/Time:								

Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Hemodialysis 3x/week	$0	$0	None (death)	0.20	0.00-0.20	0		$0	$0
	$25,000/yr		Poor	0.70	0.21-0.90	3		($45,000)	($135,000)
Note: Productivity includes annual treatment costs			Partial	0.10	0.91-1.00	7		($15,000)	($105,000)
			Complete	0.00		12		$5,000	$60,000
Continuous ambulatory	$0	$0	None (death)	0.10	0.00-0.10	0		$0	$0
peritoneal dialysis	$25,000/yr		Poor	0.50	0.11-0.60	4		($45,000)	($180,000)
Note: Productivity includes annual treatment costs			Partial	0.30	0.61-0.90	7		($15,000)	($105,000)
			Complete	0.10	0.91-1.00	12		$5,000	$60,000
Not currently available	$0	$180E+06	None (death)	0.10	0.00-0.10	0		$0	$0
See option T51	$25,000/yr		Poor	0.30	0.11-0.40	6		($45,000)	($270,000)
Note: Productivity includes annual treatment costs			Partial	0.40	0.41-0.80	15		($15,000)	($225,000)
			Complete	0.20	0.81-1.00	25		$5,000	$125,000
Not currently available	$75,000	$300E+06	None (death)	0.05	0.00-0.05	0		$0	($75,000)
See option T52			Poor	0.10	0.06-0.15	10		($20,000)	($275,000)
			Partial	0.15	0.16-0.30	20		$10,000	$125,000
			Complete	0.70	0.31-1.00	30		$30,000	$825,000

CARD 17	LIVER REPLACEMENT								FREQUENCY ~ 5K-150K/yr.
45 year old, government insurance									
Patient:	Due to tours of duty in Southeast Asia, a foreign service agent suffers from chronic hepatitis to the point of								
Doctor:	severe liver failure.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Liver transplantation	$150,000	$0	None (death)	0.20	0.00-0.20	0		0	($150,000)
			Poor	0.35	0.21-0.55	2		($20,000)	($190,000)
			Partial	0.35	0.56-0.90	10		$10,000	($50,000)
			Complete	0.10	0.91-1.00	20		$30,000	$450,000
Not currently available	$0	$180E+06	None (death)	0.20	0.00-0.20	0		0	$0
See option T53	$50,000/yr		Poor	0.25	0.21-0.45	4		($70,000)	($280,000)
Note: Productivity includes annual treatment costs			Partial	0.35	0.46-0.80	8		($40,000)	($320,000)
			Complete	0.20	0.81-1.00	15		($20,000)	($300,000)
Not currently available	$150,000	$300E+06	None (death)	0.10	0.00-0.10	0		0	($150,000)
See option T52			Poor	0.10	0.11-0.20	5		($20,000)	($250,000)
			Partial	0.10	0.21-0.30	12		$10,000	($30,000)
			Complete	0.70	0.31-1.00	18		$30,000	$390,000
Not currently available	$200,000	$600E+06	None (death)	0.05	0.00-0.05	0		0	($200,000)
See option T49			Poor	0.00		10		($20,000)	NA
			Partial	0.00		20		$10,000	NA
			Complete	0.95	0.06-1.00	20	30	$30,000	$400,000

CARD 18	LUNG CANCER								FREQUENCY ~ 200K/yr.
50 year old, private insurance									
Patient:	An executive who has smoked since age 14 coughs up some blood. An								
Doctor:	evaluation reveals inoperable lung cancer.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Conventional chemo/	$40,000	$0	None (death)	0.95	0.00-0.95	1		0	($40,000)
radio-therapy			Poor	0.03	0.96-0.98	3		($20,000)	($100,000)
			Partial	0.02	0.99-1.00	5		$10,000	$10,000
			Complete	0.00		NA		$30,000	NA
Not currently available	$40,000	$200E+06	None (death)	0.15	0.00-0.15	1		0	($40,000)
See option T10			Poor	0.20	0.16-0.35	5		($20,000)	($140,000)
			Partial	0.25	0.36-0.60	10		$10,000	$60,000
			Complete	0.40	0.61-1.00	15	25	$30,000	$410,000
Not currently available	$0	$100E+06	None (death)	0.05	0.00-0.05	1		0	$0
See option T58			Poor	0.05	0.06-0.10	5		($20,000)	($100,000)
			Partial	0.05	0.11-0.15	15	20	$10,000	$150,000
			Complete	0.85	0.16-1.00	15	25	$30,000	$450,000

CARD 19	LUNG REPLACEMENT								FREQUENCY ~ 10,000/yr.
30 year old, private insurance									
Patient:	A military officer suffers extreme radiation exposure. Recovery is slow but good except that the lung slowly scar to the point that a life-long intervention is required.								
Doctor:									
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Tracheostomy with life-	$20,000	$0	None	0.30	0.00-0.30	1		($50,000)	($50,000)
long ventilator	$50,000/yr		Poor	0.60	0.31-0.90	3		($70,000)	($210,000)
Note: Productivity includes annual treatment costs			Partial	0.10	0.91-1.00	3		($40,000)	($120,000)
			Complete	0.00	NA	10		($20,000)	NA
Lung transplantation with	$100,000	$0	None	0.20	0.00-0.20	1		$0	($100,000)
life-long drugs			Poor	0.40	0.21-0.60	3		($20,000)	($160,000)
			Partial	0.30	0.61-0.90	3		$10,000	($70,000)
			Complete	0.10	0.91-1.00	10		$30,000	$200,000
Not currently available	$8,000	$110E+06	None	0.20	0.00-0.20	1		$0	($8,000)
See option T54			Poor	0.30	0.21-0.50	5		($20,000)	($108,000)
			Partial	0.30	0.51-0.80	5		$10,000	$42,000
			Complete	0.20	0.81-1.00	20		$30,000	$592,000
Not currently available	$0	$300E+06	None	0.10	0.00-0.10	1		($8,000)	($8,000)
See option T55	$8000/yr		Poor	0.15	0.11-0.25	10		($28,000)	($280,000)
Note: Productivity includes annual treatment costs			Partial	0.45	0.26-0.70	10		$2,000	$20,000
			Complete	0.30	0.71-1.00	35		$22,000	$770,000
Not currently available	$50,000	$250E+06	None	0.10	0.00-0.10	1		$0	($50,000)
See option T56			Poor	0.15	0.11-0.25	10		($20,000)	($250,000)
			Partial	0.60	0.26-0.85	10		$10,000	$50,000
			Complete	0.15	0.86-1.00	20		$30,000	$550,000
Not currently available	$100,000	$300E+06	None	0.05	0.00-0.05	1		$0	($100,000)
See option T52			Poor	0.10	0.06-0.15	10		($20,000)	($300,000)
			Partial	0.15	0.16-0.30	10		$10,000	$0
			Complete	0.70	0.31-1.00	20		$30,000	$500,000

CARD 20	MEDICATION COMPLIANCE / MONITORING								FREQUENCY ~ 10M-15M/yr.
80 year old, government insurance									
Patient:	An elderly patient with multiple, serious medical problems is on twelve medicines which are taken from once to four times a day and at night. Some medicines depend on vital sign status.								
Doctor:									
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Trust patient to take medicines	$0	$0	None	0.20	0.00-0.20	0		$0	$0
			Poor	0.40	0.21-0.60	5		($20,000)	($100,000)
			Partial	0.40	0.61-1.00	5		($10,000)	($50,000)
			Complete	0.00		5		($5,000)	($25,000)
Have family or home health monitor	$0	$0	None	0.10	0.00-0.10	0		$0	$0
intake and VS once daily			Poor	0.30	0.11-0.40	5		($20,000)	($100,000)
			Partial	0.50	0.41-0.90	5		($10,000)	($50,000)
			Complete	0.10	0.91-1.00	5		($5,000)	($25,000)
Not currently available	$2,500	$40E+06	None	0.10	0.00-0.10	0		$0	($2,500)
See option T41			Poor	0.20	0.11-0.30	5		($20,000)	($102,500)
			Partial	0.30	0.31-0.60	5		($10,000)	($52,500)
			Complete	0.40	0.61-1.00	5		($5,000)	($27,500)
Not currently available	$3,500	$60E+06	None	0.05	0.00-0.05	0		$0	($3,500)
See option T42			Poor	0.05	0.06-0.10	5		($20,000)	($103,500)
			Partial	0.10	0.11-0.20	5		($10,000)	($53,500)
			Complete	0.80	0.21-1.00	5		($5,000)	($28,500)

CARD 21	NEW INFORMATION DISSEMINATION								FREQUENCY ~
PROVIDER TEAM									
	Assessment of a particular treatment has revealed significant variations in								
Team: INDEPENDENTS	practice within a provider group.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Write each provider a letter with	$5,000	NA	None	0.55	0.00-0.55				
standard treatment attached			Poor	0.30	0.56-0.85				
			Partial	0.10	0.86-0.95				
			Complete	0.05	0.96-1.00				
Provide data re: standard vs. variation	$50,000	$10E+06	None	0.15	0.00-0.15				
treatment on hypertext media			Poor	0.30	0.16-0.45				
			Partial	0.30	0.46-0.75				
			Complete	0.25	0.76-1.00				
Not currently available	$100,000	$120E+06	None	0.10	0.00-0.10				
See option T5			Poor	0.20	0.11-0.30				
If T5 passes, you collect $100K			Partial	0.30	0.31-0.60				
			Complete	0.40	0.61-1.00				
Not currently available	$1,000,000	$200E+06	None	0.05	0.00-0.05				
See option T6			Poor	0.05	0.06-0.10				
If T6 passes, you collect $200K			Partial	0.10	0.11-0.20				
			Complete	0.80	0.21-1.00				

CARD 22	NEW PROCEDURE ADOPTION								FREQUENCY ~
PROVIDER TEAM									
	Stories of a more expensive, non-experimental procedure with “greater success” used in another region is								
Team: HMO	requested by many members of your managed care group. Should this procedure with its added expense be								
Recorder:	adopted?								
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Categorically refuse / accept	$0	$0	None	0.20	0.00-0.20	1		$0	$0
			Poor	0.30	0.21-0.50	2		($20,000)	($40,000)
			Partial	0.30	0.51-0.80	4		$10,000	$40,000
			Complete	0.20	0.81-1.00	6		$30,000	$180,000
Study clinical medical records to see	$30,000	$0	None	0.10	0.00-0.10	1		$0	($30,000)
if it is more effective			Poor	0.30	0.11-0.40	3		($20,000)	($90,000)
			Partial	0.40	0.41-0.80	5		$10,000	$20,000
			Complete	0.20	0.81-1.00	7		$30,000	$180,000
Set up a clinical trial	$50,000	$2E+06	None	0.05	0.00-0.05	1		$0	($50,000)
			Poor	0.15	0.06-0.20	4		($20,000)	($130,000)
			Partial	0.20	0.21-0.40	6		$10,000	$10,000
			Complete	0.60	0.41-1.00	8		$30,000	$190,000
Not currently available	$25,000	$80E+06	None	0.00		1		$0	NA
See option T8			Poor	0.05	0.00-0.05	5		($20,000)	($125,000)
If T8 passes, you collect $200K			Partial	0.05	0.06-0.10	7		$10,000	$45,000
			Complete	0.90	0.11-1.00	10		$30,000	$275,000

CARD 23	PARAPLEGIA							FREQUENCY ~ 3K-6K/yr.	
20 year old, private insurance									
Patient:	A college-bound student is involved in an auto accident. All injuries except for a mid-thoracic level paraplegia								
Doctor:	have resolved. Now rehab is planned.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Traditional rehab (wheel	$50,000	$0	No lifestyle	0.15	0.00-0.15	1		($20,000)	($70,000)
chair, van, etc.)			Poor lifestyle	0.40	0.16-0.55	10		($20,000)	($250,000)
			Reasonable LS	0.40	0.56-0.85	15		$10,000	$100,000
			Complete LS	0.15	0.86-1.00	35		$30,000	$1,000,000
Not currently available	$150,000	$80E+06	No lifestyle	0.10	0.00-0.10	1		($20,000)	($170,000)
See option T43			Poor lifestyle	0.25	0.11-0.35	10		($20,000)	($350,000)
			Reasonable LS	0.40	0.36-0.75	15		$10,000	$0
			Complete LS	0.25	0.76-1.00	20		$30,000	$450,000
Not currently available	$110,000	$200E+06	No lifestyle	0.05	0.00-0.05	1		($20,000)	($130,000)
See option T44			Poor lifestyle	0.15	0.06-0.20	10		($20,000)	($310,000)
			Reasonable LS	0.30	0.21-0.50	30		$10,000	$190,000
			Complete LS	0.50	0.51-1.00	45	55	$30,000	$1,240,000

CARD 24	PREMATURE BIRTH							FREQUENCY ~ 8K/yr.	
35 year old, private insurance									
Patient:	A pilot goes into sudden and unstoppable premature labor at 23 weeks and delivers a 450 gram newborn.								
Doctor:	The newborn requires intensive treatment for under developed lungs.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Standard newborn ICU	$150,000	$0	None (death)	0.80	0.00-0.80	0		0	($150,000)
			Poor	0.10	0.81-0.90	5		($20,000)	($250,000)
			Partial	0.09	0.91-0.99	35		($10,000)	($300,000)
			Complete	0.01	1.00	65	75	$0	($150,000)
NICU with extra-corporeal	$250,000	$0	None (death)	0.45	0.00-0.45	0		0	($250,000)
membrane oxygenator			Poor	0.35	0.46-0.80	5		($20,000)	($350,000)
			Partial	0.18	0.81-0.98	35		($10,000)	($400,000)
			Complete	0.02	0.99-1.00	65	75	$0	($250,000)
Not currently available	$150,000	$120E+06	None (death)	0.20	0.00-0.20	0		0	($150,000)
See option T45			Poor	0.30	0.21-0.50	5		($20,000)	($250,000)
			Partial	0.30	0.51-0.80	35		($10,000)	($300,000)
			Complete	0.20	0.81-1.00	65	75	$0	($150,000)
Not currently available	$250,000	$500E+06	None (death)	0.05	0.00-0.05	0		0	($250,000)
See option T46			Poor	0.10	0.06-0.15	5		($20,000)	($350,000)
			Partial	0.15	0.16-0.30	35		($10,000)	($400,000)
			Complete	0.70	0.31-1.00	65	75	$0	($250,000)

CARD 25	PROSTATE CANCER SCREENING								FREQUENCY ~ 1M-10M/yr.
PROVIDER TEAM									
	In order to reduce mortality, prostate cancer screening is mandatory								
Team: HMO									
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Continue current rectal	$75	$0	None	0.40	0.00-0.40	5		$0	($75)
exams			Poor	0.20	0.41-0.60	10		($20,000)	($200,075)
			Partial	0.20	0.61-0.80	15		$10,000	$149,925
			Complete	0.20	0.81-1.00	15	25	$30,000	$449,925
Not currently available	$50	$40E+06	None	0.30	0.00-0.30	5		$0	($50)
See option T57			Poor	0.15	0.31-0.45	10		($20,000)	($200,050)
If T57 passes, you collect $100K			Partial	0.15	0.46-0.60	15		$10,000	$149,950
			Complete	0.40	0.61-1.00	15	25	$30,000	$449,950
Not currently available	$250	$180E+06	None	0.10	0.00-0.10	8		$0	($250)
See option T15+T17			Poor	0.20	0.11-0.30	13		($20,000)	($260,250)
If T15+T17 passes, you collect $200K			Partial	0.20	0.31-0.50	15	18	$10,000	$149,750
			Complete	0.50	0.51-1.00	15	25	$30,000	$449,750
Not currently available	$250	$100E+06	None	0.05	0.00-0.05	10		$0	($250)
See option T14			Poor	0.10	0.06-0.15	15		($20,000)	($300,250)
If T14 passes, you collect $300K			Partial	0.15	0.16-0.30	15	20	$10,000	$149,750
			Complete	0.70	0.31-1.00	15	25	$30,000	$449,750

CARD 26	QUADRIPLEGIA								FREQUENCY ~ 3K-6K/yr.
25 year old, government insurance									
Patient:	A pilot is involved in an accident and ends up with irreversible quadriplegia ("low quad"). No mechanical								
Doctor:	ventilator is required and speech is intact.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Standard full-time asst for ADLs and	$150,000	$0	None	0.80	0.00-0.80	1		($50,000)	($200,000)
mouth-stick wheelchair	$30K/yr		Poor	0.15	0.81-0.95	3		($50,000)	($300,000)
Note: Productivity includes outyear treatment costs			Partial	0.04	0.96-0.99	6		($20,000)	($270,000)
			Complete	0.01	1.00	15		$0	($150,000)
Not currently available	$100,000	$150E+06	None	0.40	0.00-0.40	3		($30,000)	($190,000)
See option T29	$10K/yr		Poor	0.40	0.41-0.80	6		($30,000)	($280,000)
Note: Productivity includes outyear treatment costs			Partial	0.15	0.81-0.95	15		$0	($100,000)
			Complete	0.05	0.96-1.00	30		$20,000	$500,000
Not currently available	$110,000	$200E+06	None	0.20	0.00-0.20	1		($20,000)	($130,000)
See option T44			Poor	0.20	0.21-0.40	3		($20,000)	($170,000)
			Partial	0.30	0.41-0.70	20		$10,000	$90,000
			Complete	0.30	0.71-1.00	40	50	$30,000	$1,090,000

CARD 27	SKIN CANCER SCREENING								FREQUENCY ~ 250K-1M/yr.
PROVIDER TEAM									
	Due to a tanning fads of the past, skin cancer has reached epidemic proportions. Regular skin cancer								
Team: INDEPENDENTS	screening of skin is required for large populations.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Hire physicians for	$200	$5E+06	None	0.01	0.00-0.01	5		0	($200)
screening			Poor	0.03	0.02-0.04	10		($20,000)	($200,200)
			Partial	0.06	0.05-0.10	20		$10,000	$199,800
			Complete	0.90	0.11-1.00	35		$30,000	$1,049,800
Not currently available	$200	$150E+06	None	0.01	0.00-0.01	10		0	($200)
See option T15+T16			Poor	0.02	0.02-0.03	20		($20,000)	($400,200)
If T15+T16 passes, you collect $100K			Partial	0.05	0.04-0.08	30		$10,000	$299,800
			Complete	0.92	0.09-1.00	35		$30,000	$1,049,800
Not currently available	$300	$180E+06	None	0.00		15		0	NA
See option T15+T17			Poor	0.01	0.00-0.01	25		($20,000)	($500,300)
If T15+T17 passes, you collect $200K			Partial	0.03	0.02-0.04	30		$10,000	$299,700
			Complete	0.96	0.05-1.00	35		$30,000	$1,049,700

CARD 28	TISSUE DIAGNOSIS								FREQUENCY ~ 1M-2M/yr.
75 year old, government insurance									
Patient:	A mass is found within a solid organ in a retired General. A biopsy and tissue diagnosis is required.								
Doctor:	NOTE: Outcomes refer to the ability to successfully locate the mass (and metastacized material if any).								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Real-time image guided physician biopsy	$2,000	$0		0.10	0.00-0.10			$0	($2,000)
with pathologist interpret				0.20	0.11-0.30			($20,000)	($22,000)
				0.30	0.31-0.60			($10,000)	($12,000)
				0.40	0.61-1.00			($5,000)	($7,000)
Not currently available	$3,000	$180E+06		0.10	0.00-0.10			$0	($3,000)
See option T30				0.10	0.11-0.20			($20,000)	($23,000)
				0.20	0.21-0.40			($10,000)	($13,000)
				0.60	0.41-1.00			($5,000)	($8,000)
Not currently available	$500	$180E+06		0.05	0.00-0.05			$0	($500)
See option T15+T17				0.05	0.06-0.10			($20,000)	($20,500)
				0.10	0.11-0.20			($10,000)	($10,500)
				0.80	0.21-1.00			($5,000)	($5,500)
Not currently available	$2,000	$140E+06		NA				$0	($2,000)
See option T18				0.05	0.00-0.05			($20,000)	($22,000)
				0.05	0.06-0.10			($10,000)	($12,000)
				0.90	0.11-1.00			($5,000)	($7,000)

CARD 29	UNKNOWN CRITICAL INFORMATION								FREQUENCY ~ 100K/yr.
45 year old, private insurance									
Patient:	A middle-aged shopper collapses on a week-end evening and is brought to the ED unconscious. Only a wallet								
Doctor:	is found and a driver's license reveals out-of-state residence. Physical and laboratory examinations reveal								
Recorder:	multiple, serious health problems. Time and history are critical.								
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Contact local police and	$1,000	$0	No info (death)	0.20	0.00-0.20	0		0	($1,000)
wait			Poor info	0.30	0.21-0.50	2		($20,000)	($41,000)
			Partial info	0.30	0.51-0.80	4		$10,000	$39,000
			Complete info	0.20	0.81-1.00	8		$30,000	$239,000
Not currently available	$50	$50E+06	No info (death)	0.05	0.00-0.05	0		0	($50)
See option T2			Poor info	0.10	0.06-0.15	2		($20,000)	NA
			Partial info	0.10	0.16-0.25	4		$10,000	NA
			Complete info	0.75	0.06-1.00	8		$30,000	$239,950
Not currently available	$25	$100E+06	No info (death)	0.02	0.00-0.02	0		0	NA
See option T1 or T4			Poor info	0.05	0.03-0.07	2		($20,000)	($40,025)
			Partial info	0.05	0.08-0.12	4		$10,000	$39,975
			Complete info	0.88	0.13-1.00	8		$30,000	$239,975
NOTE: Consumer should get another card for another diagnosis if he/she doesn't die.									
NOTE: This may be better as a provider card since no particular DD is given.									

CARD 30	DISASTER EVALUATION AND TRIAGE								FREQUENCY ~ 10,000/yr.
PROVIDER TEAM									
	A facility exploded massively injuring and killing many. There are a limited								
Team: HMO	number of transport units, mobile surgical suites and surgeons. Triaging & Assessment is required.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Standard field first aid	$15,000	$0	None	0.20	0.00-0.20	0		$0	($15,000)
and triaging			Poor	0.30	0.21-0.50	2		($20,000)	($55,000)
			Partial	0.30	0.51-0.80	4		$10,000	$25,000
			Complete	0.20	0.81-1.00	8		$30,000	$225,000
Not currently available	$20,000	$80E+06	None	0.10	0.00-0.10	0		$0	($20,000)
See option T21			Poor	0.15	0.11-0.25	2		($20,000)	($60,000)
If T21 passes, you collect $100K			Partial	0.25	0.26-0.50	4		$10,000	$20,000
			Complete	0.50	0.51-1.00	8		$30,000	$220,000
Not currently available	$30,000	$120E+06	None	0.05	0.00-0.05	0		$0	($30,000)
See option T22			Poor	0.10	0.06-0.15	2		($20,000)	($70,000)
If T22 passes, you collect $200K			Partial	0.15	0.16-0.30	4		$10,000	$10,000
			Complete	0.70	0.31-1.00	8		$30,000	$210,000
Not currently available	$35,000	$180E+06	None	0.02	0.00-0.02	0		$0	($35,000)
See option T22+T31			Poor	0.08	0.03-0.10	2		($20,000)	($75,000)
If T22+T31passes, you collect $300K			Partial	0.10	0.11-0.20	4		$10,000	$5,000
			Complete	0.80	0.21-1.00	8		$30,000	$205,000

CARD 31	SEVERE BURN VICTIM								FREQUENCY ~ 10,000/yr.
35 year old, government insurance									
Patient:	A person receives 3rd degree burns over 80% of his/her body while attemping to rescue children								
Doctor:	from an inferno.								
Recorder:									
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Standard burn and trauma	$100,000	$0	None (death)	0.80	0.00-0.80	0		0	($100,000)
treatment/slicing/grafting/			Poor	0.12	0.81-0.92	1		($20,000)	($120,000)
ICU			Partial	0.06	0.93-0.98	5		$10,000	($50,000)
			Complete	0.02	0.99-1.00	20		$30,000	$500,000
Laser skin removal (currently	$80,000	$20E+06	None (death)	0.50	0.00-0.50	0		0	($80,000)
NA) with grafting			Poor	0.20	0.51-0.70	1		($20,000)	($100,000)
			Partial	0.15	0.71-0.85	10		$10,000	$20,000
			Complete	0.15	0.86-1.00	25		$30,000	$670,000
Laser skin removal (currently	$120,000	$100E+06	None (death)	0.30	0.00-0.30	0		0	($120,000)
NA) with infection-free synthetic			Poor	0.10	0.31-0.40	1		($20,000)	($140,000)
shell to promote skin growth			Partial	0.20	0.41-0.60	15		$10,000	$30,000
			Complete	0.40	0.61-1.00	30	40	$30,000	$780,000

CARD 32	THREATENED EARLY DELIVERY								FREQUENCY ~ 100K/yr.
25 year old, government insurance									
Patient:	An executive has vaginal bleeding and threatened delivery at 30 weeks of pregnancy. Rest and close								
Doctor:	fetal monitoring is medically indicated.								
Recorder:	NOTE: ROI calculation is for the baby.								
Date/Time:									
Treatment options	Total treatment costs	Technology development cost	Outcome	Probability #	Probability Range	Length of recovery to 65	Length of recovery total	Productivity/ yr/patient	Total return on investment
Accept risks with no	$0	$0	None	0.40	0.00-0.40	65	70	0	$0
fetal monitoring			Poor	0.20	0.41-0.60	65	70	($20,000)	($1,400,000)
			Partial	0.20	0.61-0.80	65	70	($10,000)	($650,000)
			Complete	0.20	0.81-1.00	65	70	$0	$0
Home rest with visiting	$4,000	$250,000	None	0.30	0.00-0.30	65	70	0	($4,000)
home health and intermittant			Poor	0.10	0.31-0.40	65	70	($20,000)	($1,404,000)
fetal monitoring			Partial	0.30	0.41-0.70	65	70	($10,000)	($654,000)
			Complete	0.30	0.71-1.00	65	70	$0	($4,000)
Home rest with intermittant	$3,000	$750,000	None	0.20	0.00-0.20	65	70	0	($3,000)
fetal monitoring with			Poor	0.10	0.21-0.30	65	70	($20,000)	($1,403,000)
telemetry			Partial	0.35	0.31-0.65	65	70	($10,000)	($653,000)
			Complete	0.35	0.66-1.00	65	70	$0	($3,000)
Above with continuous	$5,000	$1,000,000	None	0.10	0.00-0.10	65	70	0	($5,000)
fetal monitoring and			Poor	0.10	0.11-0.20	65	70	($20,000)	($1,405,000)
telemetric alarms/reports			Partial	0.30	0.21-0.50	65	70	($10,000)	($655,000)
			Complete	0.50	0.51-1.00	65	70	$0	($5,000)

APPENDIX G: ASSESSMENTS OF QUALITY OF CARE

Provider 1 Patient Log

Session	Time	Patient	Provider	DD #	Card Condition	Treatment Rank (TR)	Outcome Rank (OR)
2	11:00	Middleton	Horvath	19	Lung Replacement	2	3
2	11:05	Yonas	Bennahum	10	Diabetes Mellitus	2	4
3	1:45	Padilla	Horvath	18	Lung Cancer	1	2
3	1:50	Boyce	Edmund	14	Heart Disease Diag.	2	1
3	1:50	Yonas	Hart	23	Paraplegia	1	2
3	1:47	Middleton	Horvath	29	Unknown Critical	3	4
3	2:26	Whiting/Supp.	Boom	16	Kidney Failure	2	2
3	2:30	Hayes/FDA	Franken	32	Threatened Delivery	4	4
3	3:00	Padilla	Horvath	24	Premature Birth	2	2
3	3:05	Yonas	Hart	1	Adverse DrugRxn	4	4
4	3:30	Middleton	Horvath	4	Knee Osteoarthritis	3	2
4	3:35	Padilla	Horvath	23	Paraplegia	1	2
4	3:55	Middleton	Horvath	15	Heart Disease Treat	2	3
4	4:10	Padilla	Boom	10	Diabetes Mellitus	4	4
4	4:15	Padilla	Hart	14	Heart Disease Diag.	2	2

Provider 1 Quality Assessment

		Patient								Provider							
TR	OR	Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7
2	3	Middleton	4	4	4	3	3	5	4	Horvath	4	4	4	3	3	5	4
2	4	Yonas	4	5	5	5	3	5	4	Bennahum	5	5	5	4	5	4	4
1	2	Padilla	4	4	4	3	4	4	4	Horvath	4	3	5	4	5	4	4
2	1	Boyce	4	4	4	3	4	2	4	Edmund	4	4	4	4	4	3	3
1	2	Yonas	1	1	1	1	1	1	1	Hart	3	3	5	4	2	2	4
3	4	Middleton	4	4	3	1	1	2	2	Horvath	5	5	5	5	1	4	3
2	2	Whiting/Supp.	3	4	4	4	3	2	3	Boom	2	3	4	4	4		3
4	4	Hayes/FDA	5	4	4	5	4	5	5	Franken	4	4	4	4	4	4	4
2	2	Padilla	5	4	4	2	2	1	3	Horvath	3	3	5	5	4	4	4
4	4	Yonas	5	5	5	5	5	5	5	Hart	5	5	5	5	5	5	5
3	2	Middleton	4	5	5	4	5	5	5	Horvath	5	4	4	4	4	4	4
1	2	Padilla	3	3	3	3	2	2	2	Horvath	4	2	4	3	2	4	3
2	3	Middleton	5	4	4	4	3	4	4	Horvath	4	4	4	4	3	4	4
4	4	Padilla	5	5	5	5	5	5	5	Boom	5	5	5	5	5		5
2	2	Padilla	3	2	2	1	2	1	2	Hart	3	4	5	3	2		3

Q1 - Cost was reasonable?
Q2 - Treatment was efficient?
Q3 - Treatment was appropriate?
Q4 - Treatment option minimized risk?
Q5 - Was technology adequate?
Q6 - Did the treatment improve your quality of life?
Q7 - Overall satisfaction.

Scale: 1 - very bad
2 - bad
3 - neutral
4 - good
5 - very good

Provider 2 Patient Log

Session	Time	Patient	Provider	DD Card #	Condition	Treatment Rank (TR)	Outcome Rank (OR)
2	11:05	Bendickson	Gollub	17	Liver Replacement	1	2
2	11:05	Boyce	Krummel	3	Massive Battlefield Inj.	1	1
2	11:20	Padilla	Sims	1	Adverse Drug Rxn	1	4
2	12:06	Varnado	Krummel	31	Severe Burn Victim	1	1
2	12:14	Shives?/Law	Gollub	2	Diffuse Atherosclerosis	2	3
3	1:45	Bendickson	Alverson	11	Hearing Loss	1	1
3	2:00	Boyce	Krummel	15	Heart Disease Treat.	2	3
3	2:31	Schlessinger/Ins	Davila	28	Tissue Diagnosis	1	4
3	3:00	Boyce	Krummel	18	Lung Cancer	* No treatment, patient choice	
3	3:20	Yonas	Gray	9	Heart Replacement	4	3
4	3:30	Alverson/P2	Krummel	19	Lung Replacement	2	2
4	3:38	Haas	Davila	13	Homebound Patient	4	4
4	3:40	Bennehum/P1	Krousel-Wood	5	Blindness	2	3
4	3:44	Boyce	Gray	32	Threatened Delivery	4	4
4	4:00	Yonas	Davila	2	Diffuse Atherosclerosis	2	3
4	4:00	Boyce	Gollub	17	Liver Replacement	4	4
4	4:25	Boyce	Gollub	20	Medication Compliance	2	3

Provider 2 Quality Assessment

		Patient								Provider							
TR	OR	Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7
1	2	Bendickson	4	4	4	3	3	2	3	Gollub	4	2	4		2		4
1	1	Boyce	4	2	2	2	1	1	1	Krummel	5	5	5	5	5	1	4
1	4	Padilla	3	2	4	4	4	5	5	Sims	3	4	4	3	3	2	4
1	1	Varnado	2	1	2	3	1	1	1	Krummel	3	1	5	5	4	1	2
2	3	Shives	5	5	5	4	5	5	4	Gollub	3	4	4	4	3	4	3
1	1	Bendickson	1	1	1	1	1	1	1	Alverson	3	2	3	4	1	1	2
2	3	Boyce	5	5	4	4	3	4	4	Krummel	4	4	5	5	5	5	5
1	4	Schlessinger	5	5	5	3	2	5	5	Davila	5	5	5	3	2	5	4
*	*	Boyce							1	Krummel							3
4	3	Yonas	4	4	4	4	5	4	5	Gray	5	5	5	4	4	4	5
2	2	Alverson	5	2	5	5	3	2	3	Krummel	2	2	5	5	5	2	3
4	4	Haas	3	5	5	5	5	5	5	Davila	5	5	5	5	5	5	5
2	3	Bennehum	3	4	5	5	5	5	4	Krousel-Wood	4	4	4	4	3	4	5
4	4	Boyce	4	5	5	5	3	5	4	Gray	4	5	5	5	5	5	5
2	3	Yonas	5	5	5	4	4	4	4	Davila	2	2	4	1	1	1	1
4	4	Boyce	5	5	4	4	5	5	4	Gollub	5	5	5	5	5	5	5
2	3	Boyce	4	3	3	3	2	3	3	Gollub	4	4	4	3	3	3	3

Q1 - Cost was reasonable?
Q2 - Treatment was efficient?
Q3 - Treatment was appropriate?
Q4 - Treatment option minimized risk?
Q5 - Was technology adequate?
Q6 - Did the treatment improve your quality of life?
Q7 - Overall satisfaction.

Scale: 1 - very bad
2 - bad
3 - neutral
4 - good
5 - very good

APPENDIX H: TOOLKIT INVESTMENTS

TOOLKIT OPTIONS: SUCCESS/FAILURE CALCULATION AS A FUNCTION OF TOTAL DOLLARS INVESTED																	
Assume standard deviation = 1.0 x mean (50%) investment																	
Option number		50% probability ($M)	Total invested ($M)	Paid probability	Random probability	Total probability	PASS or FAIL	Consumers	Providers I	Providers II	Insurance Payers	Legislature	Suppliers, Manuf.	FDA, Regulators	R&D Funding Orgs	Labs, Universities	Lawyers, Judges
	Assets available $ >>							300	220	220	220	300	50	80	50	30	30
	TECHNOLOGY OPTIONS																
	Health Informatics																
T1	A local Internet-based secure health information system makes patient information accessible through wide area networks. (DD29)	90	20	0.22	1.07	0.23	FAIL					20					
T2	A regional or national secure 'Personal Health Information System' with encoded cards containing essential medical information (histories, allergies, etc.) is implemented. Cost per card is twice that of issuing credit cards. (DD1; DD29)	50	0	0.16	0.96	0.15	N/A										
T3	An 'Integrated Information Technology System' that checks provider instructions against a database (with alarms & interlocks) is developed and implemented. The system can be accessed with existing computers. (DD1)	70	0	0.16	1.00	0.16	N/A										
T4	The 'Personal Health Information System (T2)' and 'Integrated Information Technology System (T3)' are developed & implemented simultaneously with full compatibility. (DD1; DD29)	110	194	0.78	1.12	0.87	PASS	105	54	25		10					
T5	An interactive multi-media system allows providers to interact with medical data and treatment variations for educational and practice purposes at $20K per system. Continuing medical education credit is given for the activity. (DD21; Training)	120	0	0.16	1.12	0.18	N/A										
T6	A secure national electronic auto-monitoring system keeps track of all procedures & allows access to current information for educational and practice purposes. Equipment costs are $20K per hospital with an additional $2K per room. (DD21; Training)	200	0	0.16	1.06	0.17	N/A										

	Outcomes Research Tools																		
T7	A widely accepted outcomes-based database is established and used as basis for medical treatment.	300	385	0.61	1.14	0.70	PASS	80	160	20	110					5	10		
T8	A national electronic medical record and information system that allows new procedures to be scientifically analyzed and compared to current procedures (cost, quality) is brought on line. Uses existing computers. (DD22)	80	85	0.52	0.89	0.47	PASS			20	30	30				5			
	Minimally Invasive Therapies																		
T9	Injectable robotic micro/nano machines that find and mechanically remove atherosclerotic and other lesions become widely available at $20K per treatment. (DD2; DD15)	320	0	0.16	0.86	0.14	N/A												
T10	Computer guided microbeam radio-surgery capable of destroying tumors without seriously damaging adjacent tissues is developed at $1.5M per instrument and $7.5K per treatment. (DD18)	200	0	0.16	0.91	0.14	N/A												
T11	A national center for Minimally Invasive Diagnostics and Therapy Research (MIDTR) is established where MIDT will be developed, demonstrated and evaluated.	250	0	0.16	0.99	0.16	N/A												
	Advanced Diagnostics																		
T12	High-performance computing advances enable real-time processing and evaluation of 3-D medical images, and facilitate breakthroughs in computational biology and drug design.	50	10	0.21	0.88	0.19	PASS					10							
T13	The sensitivity of radionuclide imaging devices is improved by 100%.	100	0	0.16	0.94	0.15	N/A												
T14	A portable, quick microwave screening technique that can be used to detect metabolically active cells that are suggestive of cancer is discovered and implemented at $150K per instrument and $150 per treatment. (DD6; DD8; DD25)	100	0	0.16	1.07	0.17	N/A												
T15	A non-invasive scanning technique that can image entire organs in the body (with the option of a 3-D video map) or biopsied tissues becomes available at $1.2M per instrument and $600 per treatment. (DD8; DD18; DD25; DD27; DD28)	120	0	0.16	1.15	0.18	N/A												
T16	A panel of approved physician-interpreters is identified. An electronic agent regularly contacts each and assigns images to interpret. The electronic agent keeps accounting records. (DD7; DD8; Telemedicine)	30	0	0.16	1.14	0.18	N/A												

T17	Advanced image algorithms that screen chest radiographs, sputum cytologies, non-invasive scan images, video maps and biopsied tissue images to identify normals and abnormals are developed. (DD6; DD7; DD8; DD18; DD25; DD27; DD28)	60	47	0.41	1.06	0.44	FAIL			25		20				2	
T18	An automated scanning technique that detects metastatic diseased tissue based on learned characteristics of a known diseased tissue sample becomes available at $1M per instrument and $500 per treatment. (DD28)	140	0	0.16	0.96	0.15	N/A										
T19	A new invasive technology to perform quantitative evaluation of coronary artery disease becomes available at $600K per instrument and $3K per treatment. (DD14)	80	0	0.16	0.86	0.14	N/A										
T20	A new non-invasive imaging technology to perform quantitative evaluation of coronary artery disease becomes available at $900K per instrument and $4K per treatment. (DD14)	350	0	0.16	0.92	0.15	N/A										
	Telemedicine																
T21	A device that provides a physician virtual-reality sensing, first aid and triaging through a paramedic surrogate becomes available at $80K per device and $150 per use. (DD3; DD30)	80	30	0.27	0.89	0.24	FAIL			10		20					
T22	A mobile field CCU, ICU transport vehicle with medic and virtual reality-with-sensors connection to remote critical care physician becomes available at $300K per vehicle and $600 per use. Option T20 is a prerequisite. (DD3; DD30)	40	0	0.16	1.14	0.18	N/A										
T23	A mobile field vehicle / trauma surgery suite / surgical assistant / virtual-reality-with-sensors connection to a remote surgeon for emergency tele-surgery is available at $500 per vehicle and $1000 per use. Option T20 is a prerequisite. (DD3; DD30)	60	0	0.16	0.95	0.15	N/A										
T24	A secure system which allows the patient to regularly and urgently connect via a telemedicine link to a health provider (who may be out-of-state) to receive or arrange for health care is made available at $400 per system. (DD13)	20	61	0.98	0.95	0.93	PASS	20		20	20					1	
T25	A secure system allowing a home health provider to connect via virtual-reality-telemedicine link to perform testing, transmit physical exam findings and discuss with a physician is made available at $70K/system. (DD13)	40	0	0.16	0.88	0.14	N/A										

	Microelectronics and Sensors																
T26	Vital signs monitors/transmitters become widely available at $200 per unit. (DD13)	30	55	0.80	1.15	0.92	PASS						50			5	
T27	A vital signs and blood chemistry (O2, hemo, cholesterol, cell counts) monitor becomes widely available at $250 per unit.	50	55	0.54	1.10	0.59	PASS	25		25						5	
T28	Guided microsurgical instruments linked to 3-D anatomical displays replace traditional instruments at a cost of $130K per surgery unit.	200	0	0.16	1.08	0.17	N/A										
T29	Voice-controlled robotic assistants that can provide most or all care for paraplegic and quadriplegic patients become available at $70K per robot. Transportation and work-place facilitators provide additional aid. (DD26)	150	0	0.16	1.00	0.16	N/A										
T30	An integrated imaging, biopsy, tissue processing/diagnosis robotic apparatus that precisely performs the instructed biopsy and processes and diagnoses the abnormalities becomes available at $1.7M per instrument and $800 per treatment. (DD28)	180	0	0.16	1.07	0.17	N/A										
T31	A compact device that keeps tabs on groups of injured people using non-invasive technology (e.g., microsensors with telemetry or infrared telethermometry) is made available at $80K per unit. (DD30)	60	0	0.16	1.11	0.18	N/A										
	Energy Delivery Devices																
T32	Laser-based microscopy enables early detection of disease-causing agents.	150	0	0.16	0.91	0.14	N/A										
T33	A laser device that removes (rather than fracturing or dilating) atherosclerotic lesions becomes available at $300K per unit and $3K per treatment. (DD2; DD14)	80	20	0.23	0.85	0.19	FAIL					20					
T34	A visually-controlled laser device that removes (rather than fracturing or dilating) atherosclerotic lesions becomes available at $450K per instrument and $4K per treatment. (DD2; DD14)	120	0	0.16	0.93	0.15	N/A										
	Assistive Technologies for the Elderly/Disabled																
T35	An artificial cartilage material that can be used to replace damaged cartilage and prevent osteoarthritis becomes available at $600 per treatment. (DD4)	70	85	0.58	0.90	0.53	PASS					70			15		

T36	A device that will differentially identify basic environmental elements using different sounds to provide talking sight to the blind becomes available at $12K per unit. (DD5)	80	0	0.16	0.88	0.14	N/A												
T37	A device that differentially identifies environmental elements an connects to the retina, optic nerve or cerebral cortex to result in useful sight becomes available at $28K per unit. (DD5)	180	0	0.16	0.94	0.15	N/A												
T38	A cochlea implant that allows noise but not distinguishable speech to be heard becomes available at $6K. (DD11)	70	0	0.16	1.10	0.17	N/A												
T39	An artificial ear that would allow for speech perception becomes available at $14K. (DD11)	200	0	0.16	1.15	0.18	N/A												
T40	A light-weight, comfortable walking hip cast/exoskeleton with which a patient will walk until healing occurs becomes available at $3K. (DD12)	110	0	0.16	1.04	0.17	N/A												
T41	A machine that dispenses correct medicines per time with adjustments for VS becomes available at $2.5K. It also notifies patient to take medicines. Tele-link alarm for missed doses or out-of-range VS. (DD20)	40	0	0.16	0.91	0.14	N/A												
T42	A machine that dispenses correct medicines either orally or percutaneously per time with adjustments for VS becomes available at $3.5K. Tele-link alarm for missed doses or out-of-range VS. (DD20)	60	65	0.53	1.09	0.58	PASS			30					35				
T43	Surface muscle stimulators that externally provide electrical stimulation of leg muscles with computer coordination for walking become available at $12K. (DD23)	80	0	0.16	0.91	0.14	N/A												
T44	A walking exoskeleton that allows use of arms and legs (walkin becomes available at $110K. This allows a quadriplegic patient to use predominantly self-care. (DD23; DD26)	200	0	0.16	0.93	0.15	N/A												
T45	A device providing liquid ventilation becomes available at $50K It uses an oxygen and carbon dioxide carrying fluid (instead of air) as the ventilating medium. This would allow the lung to mature prior to breathing air. (DD24)	120	0	0.16	0.88	0.14	N/A												
T46	An artificial womb comprised of a fluid enclosed environment with an artificial placenta connected to the umbilical vessels and through which nutrients are received and waste products are eliminated becomes available at $150K. (DD24)	500	0	0.16	0.88	0.14	N/A												

	Internal Organ-Related Technologies																		
T47	A human-compatible xenogeneic heart obtained from genetic engineering of a suitably sized animal becomes available at $20K. Life-long anti-rejection drugs may or may not be needed. (DD9)	300	0	0.16	1.07	0.17	N/A												
T48	A new artificial heart with some external connection to assist or replace heart function becomes available at $30K. (DD9)	250	0	0.16	0.88	0.14	N/A												
T49	Tissue cultured and implantable human organs or replacement cells (heart, liver, pancreas, kidney) become available at $35K. (DD9; DD10; DD17; lung, kidney replacement)	600	90	0.20	1.11	0.22	FAIL					90							
T50	An implantable artificial pancreas with a sugar sensor and insulin reservoir that monitors and treats increases in blood sugar becomes available at $7K. The reservoir would need periodic filling with insulin. (DD10)	160	0	0.16	0.89	0.14	N/A												
T51	An external, artificial kidney that provides continuous (or at least, nocturnal) hemodialysis becomes available at $12K. Life expectancy and medical problems are expec-ted to be much improved over traditional dialysis.(DD16)	180	0	0.16	0.86	0.14	N/A												
T52	Small implantable artificial organs (kidney, liver, lung) that function acceptably become available at $50K. Life expectancy and medical problems are expected to be much improved over traditional treatments. (DD16; DD17; DD19)	300	0	0.16	1.16	0.18	N/A												
T53	A liver dialysis machine that intermittently or continuously cleanses the blood of toxins usually cleared by the liver becomes available at $26K. (DD17)	180	0	0.16	0.88	0.14	N/A												
T54	A light-weight portable exoskeleton ‘Iron Lung’ that fits over the chest and through negative (and ± positive) pressure causes air to move in and out the lungs becomes available at $8K. (DD19)	110	0	0.16	1.01	0.16	N/A												
T55	Infusible artificial chlorophyll, a substance or micro-machine that absorbs carbon dioxide and releases oxygen in the blood stream becomes available at $8K. (DD19)	300	0	0.16	0.91	0.14	N/A												
T56	An external portable artificial lung that will take up oxygen from and eliminate carbon dioxide to the external environment becomes available at $30K. (DD19)	250	0	0.16	1.00	0.16	N/A												

	Preventive																
T57	Mobile cancer screening units become widely available for breast and colon cancer screens at the patients' locations. Costs are $500K per unit and $250 per screen. (DD6; DD8; DD25)	40	25	0.35	1.15	0.41	PASS			20						5	
T58	A 'safe' cigarette is developed that supplies the desired nicotine effect without delivering the tars and hydrocarbons that lead to the undesired effects. (DD18)	100	0	0.16	0.95	0.15	N/A										
T59	A system for patient education and behavior modification (diets, smoking cessation, exercise, etc.) becomes universally available	30	63	0.86	1.04	0.90	PASS	10	6	15	30					2	
	NO ADDITIONAL TECHNOLOGY OPTIONS ADDED																
	Technology Subtotals =	8590	1290					240	220	210	190	290	50	0	50	30	10
	POLICY OPTIONS																
P1	The FDA reduces the time period for new technology testing by 50% by changing internal agency rules and procedures.	35	20	0.33	0.88	0.29	FAIL										20
P2	Medical malpractice lawsuit punitive damage cap set to $1,000,000.	400	10	0.16	0.89	0.15	FAIL			10							
P3	A single-payer national health care system is implemented.	600	0	0.16	1.13	0.18	N/A										
P4	Congress establishes missions for the national laboratories which include biomedical technology transfer with industry.	40	0	0.16	1.02	0.16	N/A										
P5	FDA establishes international standards together with Europe & Asia, thereby expediting worldwide marketing of new products by harmonizing device and software testing requirements and reducing duplicative testing.	60	0	0.16	1.06	0.17	N/A										
P6	FDA develops pilot program to work together with industry to reduce the time to bring new technologies to market by 75% (using FAA-like Boeing 777 "model").	70	10	0.20	1.10	0.22	FAIL							10			
P7	Medicare develops PPO managed care plan with patient option for doctor/treatment choice outside of plan at 20% of cost.	70	0	0.16	0.98	0.16	N/A										
P8	FDA implements a medical devices product development consultant accreditation process to reduce overhead time.	30	30	0.50	1.04	0.52	FAIL							30			

P9	Given that P8 passes, additional steps are implemented to reduce the FDA review and approval time by 75%. This does not affect clinical trial time.	30	30	0.50	0.90	0.45	PASS							30				
P10	Congress establishes private savings accts for health care along the current IRA model. Incentives are provided for private investments in biomedical technologies.	30	60	0.84	1.00	0.84	PASS	30			30							
P11	The federal legislature will fund/provide balanced meals and immunizations for needy children. Annual funding $20M from the health care budget and $80M from non-health care budget.	30	30	0.50	0.92	0.46	PASS	30										
P12	Given that technology option 'T1 - Secure internet HC info system' passes, FDA will have access to all necessary information to investigate incidents and evaluate post-marketing surveillance information.	30	10	0.25	1.12	0.28	PASS							10				
	Policy Subtotals =	1425	200					60	0	10	30	0	0	80	0	0	20	
	Grand Totals =	10015	1490					300	220	220	220	290	50	80	50	30	30	
	Team Credits Available =		1500					300	220	220	220	300	50	80	50	30	30	

APPENDIX I: DETAILED DESCRIPTIONS OF TEAM ACTIONS

Consumers

Team Members

Marie Garcia, Facilitator; Gladys Shaw, Recorder
Gil Padilla, Amy Haas, Blackford Middleton, Gerry Yonas, Joe Boyce (present at 11/1 and 11/2 sessions only), Beverly Bendicksen, Robert Bestgen (present at 11/1 session only)

It was obvious from some of the comments and questions that several players had not read the Handbook, or had perused it very quickly.

Some were confused as to 'who' the Consumers are. Big Business that purchases group insurance? Some were concerned about health care for the 'poor' (12-1/2 percent of the population), and those who paid no insurance. One commented that the game was unrealistic because it did not take that group into consideration. [*Ed. note: This was explicitly incorporated in the Medicaid portion of the government insurance.*] Another stated that a hospital in San Jose, CA was forced to close because of treatment and care for illegals.

Some of the stated objectives from brainstorming session:

Be alive at end of game (8 yrs)
Increase quality, decrease costs
Minimize managed care
Never be ruined financially
Education about leading a healthy life
Medical information that ordinary people can interpret
Risk-adjusted premiums; plus rebates (self-directed account/tax credit)
Home tools for managing health care (home triage advisor)
Control of own lives
Stay at home for most of health care
Want Nordstroms product at Walmart price
Research
U.S. health care best in the world

Team members decided that decisions would be by majority vote. Roles selected for insurance purposes were:

Govt.		Private	
HMO	IP	HMO	IP
Joe		Blackford	Gerry
Amy		Gil	
Beverly			

Discussion:
Should reconnect fiscal accountability with individual health responsibility; want maximum health care at minimum cost.

System Solution - for lifetime:

Education, Information, Access, Connection to system, Feedback, Learning

Are we responsible consumers or irresponsible? Are we going to behave in reptilian or altruistic manner? Shall one goal be to decrease health care costs to roughly 1-1/2 times inflation rate rather than double inflation rate? Probably not feasible.

Supplier team approaches to inquire what devices consumers need and want from them--
Information systems and connectivity was the consumers' response

Discussion: What do consumers want?
From insurance companies: risk adjusted premiums
Financial incentive to stay healthy (from insurance companies and govt.)
From suppliers/labs: access tools/personal information
Home tools/affordable and reliable
National health care infrastructure
Information from hospitals and providers
Real-time connectivity with provider w/feedback

Discussion: Talk to providers to demand information needed to make rational decisions
Insurers need to know we're willing to assume fiscal responsibility for our health, but expect a rebate
Offer purchasing power to buy things we want
Announce to media that consumers are disenchanted with health care system and
--"We're not going to take it any more"

Problems expressed by several players:

- concerned about money (consumers' own money vs. Medicare/medicaid $)
- true definition of government consumer
- didn't have clear understanding of steps of game

10:40 Patients receive D/D cards and go for treatment; lawyer, as well as several others, become patients and come to Consumer group for information on procedures.

1:00 Presentation by Provider 1 group on insurance coverage; insurers are writing new policy for private consumers. Government workers having difficulty obtaining insurance. All policies offered cost $48,000, with little difference in coverage. Control team intervenes and changes government patients to private because insurance company team wasn't ready to offer government patients insurance. One patient self-insured .

1:30 Several consumers now have money left and are contacting labs/universities to invest in technology to help paraplegic/quadriplegic patients. One patient receives money from lawsuit and invests in technology.

Provider 2 team offers Consumers HMO plan of $38,000 premium for 2 years, no co-pay, no deductible, but not covering transplants. Most of the consumers opted for this plan. Tyrone negotiated transplant rider for additional fee. Because insurer and supplier teams were not busy, consumers drew an additional D/D card. (This was done several times.)

Two from consumer group testified to legislature regarding government money given to insurance team which was not expended on government patients, and complaints about unsatisfactory treatment from insurance companies.

Marie tells team that they need to discuss goals to determine if they were accomplished.

Agreements Negotiated

1. Signed agreement with Insurance team to invest in Toolkit Options T4, T7, P10.
2. Agreement between Consumer and Provider teams to settle claim for personal injury caused by defective device approved by FDA.
3. Consumers, et al., sign agreement with Provider 2 for full medical benefits for $38,000 for two years' coverage.
4. Consumers/Provider 2/Univ-Lab teams signed agreement to fund research in mobility systems; light-weight, compact life-support systems; communication systems; and back-up batteries.

One proposal to fund and establish a non-profit research institute to study and define best practices for US. healthcare failed because of lack of support by insurance companies.

November 3, 1995

ISSUES AND SOLUTIONS SESSION

PROBLEMS/ISSUES

1. Consumers need access to information they can understand and count on:
   choices; pay more/pay less; history; Consumer Report-type magazine
2. Want doctor to have access to individual health records anytime, anywhere needed and want doctor to have access to best information to allow the best decision to be made.
3. Want an array of choices in order to choose best possible level of health care.
4. Need to have health financial incentives.
5. Want tools (hardware/software) to provide for self-care; also a connection to a system that allows for backup/safeguard.
6. Need for the quality and cost of HMO and the feel of Fee-For-Service (Nordstrom vs.Walmart).
7. Need for personalized health care.
8. Not enough concern in the health care industry about those consumers who become disabled; problem with orphan diseases.
9. No one wants to be left out; no matter the problem, want treatment/solution.
10. How do you provide health care to those who can't pay for it/have no insurance?
11. Need to address runaway litigation.
12. Would like to have access to high-quality health care independent of location.

Three Issues chosen:

1. **Need access to health care information and medical records that is accurate to help us make health-care decisions about:**
   Provider, Hospitals, Treatments, Drugs, Technologies, Self-Care, Costs
   Solutions: National healthcare information infrastructure
   Outcomes management information network
   Standards

2. **Improve consumers' ability to care for themselves and family in the home, and practice preventative medicine**
   Solutions: Linkages to provider

Home monitoring and surveillance
Home diagnosis and therapy
Home health "Quicken"

3. **Health care for the uninsured and underinsured**
   Solutions: Immunization, Mobile clinics
   Implantable birth control

FINAL PRESENTATION—Gil Padilla

GOALS/STRATEGIES

GOAL A. Maximum health care @ minimum cost
Measurable: continuous decrease in illness incidence and prevalence
Cost? (metric)
Strategies: Self-care and prevention; New cures/treatments; Education; Information (access to and interaction with); Risk adjusted/rebates; Consumer informatics; Active consumer groups; Political action committee; Tie between individual risk and cost

GOAL B. Acceptable choice of providers and treatments
Strategies: Quality and service of the providers (hospitals and doctors); Consumer access to information; Layman knowledge about treatment and outcomes; Information systems and connectivity; Flexibility of insurance design

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LESSONS LEARNED

- **Health care system is almost impossible to model comprehensively in a game environment with these time constraints**
- **How monies flow dominates everything**
- **Role of technology is swamped by other factors (financial, social, political)**
- **Consumers had little control in determining health care costs**
- **More dollars spent on administration and the system than on improving and developing actual technologies**
- **Investment in information technology did pay off**
- **Lots of desire for self-care, home care**
- **Need better management of existing technologies**
- **Uninsured are the driving force in cash flow, yet not allowed in the game**

ACCOMPLISHMENTS

- **Consumers led the way in identifying essential technologies that are consumer focused (our Toolkit investment was highly leveraged)**
- **Politically active**
- **Able to leverage costs -- by negotiating with insurance company and providers**
- **Behind-the-scenes work to bring teams together**
- **Effectively established connections with other groups**
- **Interacted with the media and legislature to influence public opinion and decision making**

Independent Providers 1

Players: Dr. David Bennahum, Dr. Ried Boom, Dr. Edmund (Tony) Franken, Dr. Blaine Hart, Dr. Andrew Horvath, Dr. David Rattner, Dr. Richard Re
Facilitator: Pace VanDevender, Recorder: Paula Schoeneman

Wednesday, November 1, 1995 - Dinner discussion: After introducing themselves and giving a brief biography, the Independent Providers team quickly began discussing their views and opinions on the Health Care Industry. They agreed their role in the industry was very different from HMO physicians. The issue of how Independent Providers were evolving was a hot topic; their private practices could disappear, especially if they were linked to a corporation. They also discussed gene mapping, follow-up of prevention, and wellness. "When you have the right technology, prevention is cheap," was one viewpoint. Other points made were: "It will cost millions of dollars in R&D to achieve the results", "The test of value is how cheap it is in the final analysis." "If you save the heart patient, you have to increase his pension." The team agreed to do their homework: review the Toolkit options.

Description of Strategic Planning Session
The Independent Provider Team saw HMOs and single physician providers at the extremes of a continuum on control of business and clinical decisions. The Independent Providers chose to be an Independent Multi-specialty Group because it is seen as the model into which independent physicians are evolving in response to social and economic pressures. They wished to have control over both clinical and business decisions but still have access to the capitation dollar through agreements with Insurers and HMOs. Their entrepreneurial spirit as Independent Providers differentiated them from the perceived institutional mindset of the employee-doctors of HMOs.

During the Strategic Planning session, the insurers, suppliers, and lawyers approached the Independent Physicians and helped them focus on system-level business issues.

The group developed a decidedly entrepreneurial business mindset (making more money) and decided on the following set of challenges:

- Provide a way for independent physicians to obtain clout and work together effectively
- Get access to the capitation dollar without giving up control of business and clinical decisions
- Improve efficiencies to increase margin between costs and capitation dollar income.
- Differentiate independent providers (in the minds of patients) by nurturing the personal physician-patient relationship and by being first adopters of new technology through relationships with suppliers and regulators

Issues and possible solutions were developed as follows:

Issue: Linking independent physicians into effective care delivery units while maintaining entrepreneurial spirit, maintaining focus on the patient, and maintaining physician leadership

Solutions:

- Legislative relief to allow physicians to aggregate and assume risk
- Info systems which link business practices, outcomes, patient records, allowing seamless movement of patients through the system
- This will improve quality, reduce waste, and therefore lower cost/unit of service
- Decision support software - validated and up-to-date
- Physician incentives to use networks (interfaces, and culture)

Issue: Keeping the focus on quality
Solutions:

- Patient-centered care
- Continuous quality improvement, (constructive, critical internal review)
- Commitment to valid outcome data (to obtain, to implement)
- Preserve physician prerogative to adopt or test new treatments or technologies within appropriate professional guidelines
- Informatics with quality metrics
- Reward quality care: define and use metrics
- National program for outcomes/standards

Issue: Increase efficiency by implementing waste-avoiding technologies including maximal use of clinical and management information systems linking all components of health care network.
Solutions:

- Secure electronic medical records
- Secure telemedicine
- Administrative management information system
- Physician education to get them "on line" and trusting of virtual (e.g. as infrastructure
- Legislative clarification of who owns data and terms of use
- Care mapping as standards of practice
- Technologies for outpatient care to replace inpatient care
- Obviating multiple (redundant) tests
- Therapeutics with a single cost effective diagnostic, avoiding redundant diagnostics and their excess cost

Role Assignments
The Independent Physicians functioned as a Team and agreed to make decisions on the basis that everyone must be able to live with the decision. Team members were empowered to act independently provided they acted from the team goals and strategies. Patients would be served by the most available doctor when the patient approached the providers.

Team Challenges and Objectives
Challenges and objectives were developed from the issues and potential solutions by networking with insurers, suppliers, R&D agents, and lawyers. Competitive instincts and the need to avoid anti-trust issues associated with deals that might reduce consumer choices limited interactions with the HMO team.

All objectives were accomplished during the Game.

Challenges	Objectives
• Maximize information systems	• Obtained Toolkit Options T4, T7; Physicians Group Management Information System (PGMIS) links independent providers into a virtual organization; Secure Information System; AOL Medical Information for profit Intelligent Agent; National Outcomes Database
• Waste-Avoiding Technology	• Joint Venture on accident reduction, National Outcomes Database
• Maximize Home Care	• AOL Intelligent Agent to screen; β-test of home monitor

• Differentiate as first adopters	• Agreements with R&D, Suppliers, FDA for first access
• Avoid anti-trust by preserving choice	• Preserved choice by patient
• Relief from insurance reserves	• Obtained Legislation • Continuous quality improvement through constructive internal peer review

Significant Highlights of the Game

The Independent Providers were very entrepreneurial business people with value for the patient.
When events got hectic, facilitator had to prompt players to care for the patients. Two patients left waiting turned to the HMO team for treatment. Two doctors provided most of the treatments and did so in a very caring manner.
Outcomes research is very important.
When independent providers have access to the capitation dollar they are driven to lower costs and increase efficiencies to increase profits--a reasonably healthy imperative.

Through the interactions within the Prosperity Game, the Independent Providers grew naturally into a new model for Independent Physicians:

- Organized as confederation of independent practices
- Linked by an effective information system
- Granted local control over accepting or negotiating capitation rates with patients to provide choice for the consumer and to provide protection from anti-trust regulations
- Granted local control on clinical decisions
- Differentiated from HMOs as being closer to the patient in a personal physician-patient relationship
- Differentiated from HMOs by being first to adopt new technologies through alliances with suppliers and regulators and through an exclusive arrangement to conduct clinical trials
- Assumed the global risk and the profits as an entrepreneurial health care business
- Outsourced administration of insurance premiums to insurers for 10% of premium dollar
- Organized politically for protection from anti-trust difficulties and relief from requirements to keep large cash reserves to back up their financial risks

What Worked Well

- The composition of the Independent Providers was excellent.
- The two types of money worked well. Requiring patients to be responsible for their own funds freed up the recorded to focus on the flow of the game.
- The interaction with the other interests (especially insurers, suppliers, lawyers, and legislature) stimulated development and maturing of strategies.
- Collection of issues and technologies by Roadmapping Group was a good start to couple the Game to the Roadmap.
- David Bennahum was picked as a patient by the draw from the Grim Reaper. He went to the HMO team for treatment. The Providers-1 thought it was comical.

What Needs Improvement

- Formally ask the facilitators of the Roadmapping to start by going over the matrix of outcomes from the Game for his or her roadmapping team and discuss them to internalize them.
- Balance the Roadmapping Teams to assure adequate expertise is available for a meaningful roadmap.
- The facilitator must assess the relative competence of the Roadmapping Team participants and assure the most knowledgeable get more air time.

- Monitor the networking around the Toolkit Wall Chart. Our team found it too easy to obtain the information from the chart and did not make contacts with all teams for subsequent negotiations.

General Observations

The team was very innovative. Surely many would criticize the outcome as being unrealistic on at least three points: Independent physicians will not want to ban together, insurers will not let independent physicians assume the risk and the rewards, and the organization of independent physicians would find regulating its poor performers to reduce risk to its members would force it to become an HMO. However, the right set of leaders with vision may well be able to implement this strategy. The members of the Independent Providers Team displayed the right kind of vision and realism to encourage my belief that their plan could be implemented. At the very least, the entrepreneurial imperatives of the independent physicians appeared to be real and are probably able to maintain a differentiation from HMOs.

A comment made by one of the team members was "The whole second half of the game has been perverse. We got what we wanted right away and spent the rest of the game being bankers. Our behavior has been very entrepreneurial." This was very true. The team immediately knew where they were going in the game, how they were going to play it, and all they wanted to do was "win". How true to life this must be for many physicians in the real world. They graduate from medical school, and immediately are in debt. They have to become entrepreneurs in order to establish a medical practice, pay for their malpractice insurance, the costs associated with running a business, and paying back student loans. They are not taught how to run a business in medical school. All they know is how to treat a patient. This is something they learn very quickly or else they have to resort to going into a group practice or an HMO.

Player Quotes

"What did we learn? If the doctors focus more broadly, we could be in less trouble today. We've lost our ability to insist on universal insurance. It's a petty and narrow perspective. We've allowed this to occur. There are patients without insurance. It wouldn't have occurred if we hadn't been so narrow-minded. Doctors were against Medicare and not paying attention to the non-insured. This is a political discussion. Since this has come up, doctors won't deal with it. They cannot say this is not our problem. We have a moral obligation to take care of them. We can benefit from them. We would make money. This is irrelevant within the game."

"One thing that was a key driver was that we became entrepreneurs. Given the way the market is currently delivered you can get killed. The way to succeed is entrepreneurial ventures, not one-on-one care. The issue is systems and integration, not how I care for this patient that had a heart attack. The more you diversify, you move to the more profitable ventures. In this synthesis, we need to deal with that has its potential downside as well. After we made our first deal, the patients became secondary. We weren't patient focused. We were business focused. The patients came to us when they perceived they had patient choice. All we wanted was the numbers. We had to learn to stay patient focused while doing the business."

New Model for Independent Physicians

"Ideally you would like to think we went from Providers to HMO's as a medical model. Is there a medical model to retain autonomy but retain cost benefits? We have all the incentives of HMO's and took capitation and took 10% overhead. We have unrestricted access at the same price. This was the first move we made in the game and it paid off. We are going to accept 20% and no legal costs to bankrupt the HMO's."

"We partnered with the insurance company which moved us to where we wanted to go. We networked the other doctors, and partnered with the Insurance team on an appropriate basis. It's possible to do it inappropriately, otherwise we're dead fish. We thought we were in the hole with the money. That's the nimbleness of doctor controlling decisions that control costs. Doctors are entrepreneurial."

"You can be an independent practitioner and still have capitation. You have a panel of patients and a given budget. Independent physicians have more autonomy and can choose programs to decide what clinical level and administrative level are appropriate. They have more control."

"If this is our aim, then the capitation dollar defines our need. Without the capitation dollar, you go broke. You lose your shirt. Big HMO groups are learning a bitter lesson. Number one is information technology. We need to build bridges. If you don't know what's going on between all of this, then you don't make money. You have to have it at your fingertips. You need all the information and new technology to make money. The need lets Independent Practitioners act as a virtual company and it aggregates them."

The insurance team approached the table. They felt they were more in tune with the Independent Providers than with the HMO Providers. They wanted to know the mission of the Independent Providers.

The Lawyers approached the table at 9:05 AM. There may be anti-trust problems with the groups communicating with each other. No-one has brought it up yet. They will provide counsel to people.

"Independents don't want price fixing. It only involves a small segment of the market. All anti-trust issues drive up the cost of care. We need an approach to anti-trust. Don't put in price fixing per se. Bigger issues as Independents come together and risk sharing, creating new policies, and sharing information. It will become more clear as we get into Telemedicine and new social patterns. Need to go to the lawyers and tell them what they need is House regulations to get relief from anti-trust. They need relief from the reserve requirements that the HMO's now have. They are in favor of facilitating a private practice joining in aggregation and have specialty exemption for small communities for physicians cooperation."

The Insurance team came back for their appointment. They have reinvented themselves. They don't want to become obsolete. They want to promote health and to provide a balance to the physicians and patients as mutual customers. They will use their experience and massive data systems to design individual products as one-on-one and person by person match-up with the providers. They are different than the HMO's. They walk in off the street. Rather than being risk managers, they will have control. They felt they were more in synch with the Independents. They want to match up the consumers with the right providers. They want to provide the best service. They wanted to know what the Independents wanted from the Insurers.

The Independents want a contractual relationship. There are points of agreement and differences. The insurance team hasn't envisioned that yet but are willing to rethink it and come to an arrangement. There should be a general fee for services. Universality is the number one thing that has changed. They want universal access to health care in tailoring it to the consumers. They want to reduce their risk and also share the risk. They want insurers to take the risk, use their money to market their plan and have universality for all patients.

There should be division of labor, have the insurers help us define information technology to enhance communication between the patient and the provider and the hospitals; market the claims and keep underwriting universal. They are willing to do this on an individual basis. After several rounds of discussion, a 90/10 split of the premium dollar for provider/insurer was agreed.

Discussion was still happening on the agreement with the Insurers. The Independents want to push alternative medicine savings account for 5%. Go with whatever they want. We will provide services. If something has good clinical data, with effective outcome, then we will embrace it. The team concurred. The deal with the Insurance Team was agreed and signed at 10:34 AM.

The team regrouped. They finally accomplished the capitation agreement with the Insurance Team. The team decided they needed legislation to have support if they assume the risk. They decided they may need advice from the lawyers. They didn't set aside any money for liability insurance. They decided not to put any resources into it.

"We need to get a lawyer to get legislative relief. This is a high priority. We need to stay independent of the HMO's. We have to be able to assume the risk. We need to be on firm footing. We want to be exempt and be permitted to assume risk. We'll sign an agreement. Can go directly to Congress. We need to go to the Consumer Team before we go to the legislature."

"What are the issues? There are two groups of providers. The anti-trust laws are in place to protect the consumers. There is consumer choice. There is no price fixing, restraint of trade. If you get together and agree to joint venture and share one product. Where does it leave the consumer? No choice. Get advice from council. Act as competitors, unless you want the dog or FTC coming down on you. Team has agreed to discuss this. If you share price information at all, it will raise a red flag. Don't share price information. The government doesn't have the ability to issue a consent decree. Does that prevent us from hiring joint services? As competitors, that wouldn't be in our best interest."

Differentiation from HMOs as Entrepreneurial Providers - 1: "We are as close to being an HMO as we want to be. We are not losing, but we want to win. Do we have a win strategy? We need to have a risk vision and mission. The present mission is to make a living. It's extremely hard to achieve it. Our market share is doing very well. We have 100% of the market share or reducing our cost because the only 2 contracts have been sold. Do we have anything to take to the consumers to offer? (argument). If they go to the HMO's, then they get lower services. They have better chances staying with us. How do we persuade them to take the risk? Advertise! The consumers can't go with full HMO treatment. They need to stay with us. We need to put the money back in the game. We need to sell ourselves."

"How do we convince Independent doctors it's in their best interest to band together? Doctor education. But there are legal aspects to what you can do. There are different constituencies and you have to get components together and get people to work together without it being risky. While preserving decision making, unless you work together, you won't have the power. The crux of the anti-trust issue is you can't work together, and you can't be independent if you work together."

"The real life parallel is you need an organization for the doctors, for the independent providers. The organizer can be the insurance collectors and fund the money to you. We could have taken the others. We had to use the insurance companies in the game. The HMO marketed to the Consumers from day one. We had all the advantages of the HMO's without the restrictions. The HMO's played unfair though."

"The AMA can advocate for specific issues for legislation, but can't organize anything. Nobody is neutral about the AMA."

"How to network effectively. We had physician leadership. We were driving the bus, whether we were collecting insurance money or not. The insurance company figured out they were superfluous. They had to

make a deal. We also assumed risk. The physicians are willing to take the reward but not so willing to accept the risk. We don't like the idea of being unemployed or going broke."

"Physicians don't have the capital, although there are several sources other than Insurance Companies. Hospitals can be not for profit systems. We didn't talk about partnering with them. We're in the same position as specialists. Everything is uneasy."

"There is capital out there, very cheap. It doesn't have a price tag. It depends on the product beyond the scope of this game. This is going to be the test of philosophies and products among the physicians."

"We first put a great delivery system in that we gave choice, then we gave them quality. We weren't really in the market, not a real competitive advantage. It's clear that the perception in primary care is more expensive. You'd lose money in the way you make choices. You can make choices to introduce bureaucracy, nimbleness and entrepreneurial spirit. You can make a huge network. You need to be quick on your feet."

"Business people make judgments. We want patients; there is a clear differential. Business people can set up our structure. It's a vendor driven thing. We request more information than typical business systems. It's part of our job to influence the patient before they make a decision. It's part of our business. Arbitrary decisions are made with very little evidence. Part of our job is to maintain quality. This is an enormous challenge. Outcomes research is a driver. We have to have standards for capturing data. We need to do it electronically. It can't be run by chart review."

Technology

"Do Independent Providers take a role in technology? They use it to reduce their cost and avoid waste. If you have a new procedure using new technology, you save time but can charge the same fee. If you keep putting in new procedures that HMO's may not use, the independents can make more money. You become more trained. We need to become established as the market leaders in new technologies. "

"The money comes from industry for producing new technologies. Physicians should make an alliance with industry. There is also opposition on this alliance. It's not the primary challenge. There can be technology developed for home care to help the patient avoid running to the hospital or doctor's office every time they feel sick. There could be monitors on the telephones. Technology can be good. It's a money maker. How do you make money if home care rises? You have to charge for it. When we own the capitation dollar, the incentive is to keep people out of the hospital."

"Discussion: We should invest in technology because of all the money we have. The biggie is T-49. It's beyond our capabilities. We could go to other funding sources and develop a CRADA where intellectual property resides. We could also look at non-invasive technologies and information networks (they are now up and running but control is not available until the year 2002). Insurance companies want to know about the info networks. Will the government give us more money if we prove we are more efficient in managing the networks than the Insurance companies. "No". What else can we do to get more patients?"

"We should put together a tracking system for groups to allow us to do quality testing. We could then market them. It would be the same as T-4 and T-7. We have the data. The National outcomes is not the same thing. It's internal within the clinic. It will reduce our cost and produce total quality improvement. What parameters do we have? We need to go for the $120M probability. We need an official agreement

saying that there will be no other lawsuits. We need an insurance policy (for malpractice, with limitations, only catastrophic, self-insured, for first 1M)".

"We created this America On Line (AOL) system in accord with our strategy for improving home care for $5M. AOL subscribers can access this diagnostic tool for screening symptoms for $2 and it gives us $1 per access for estimated return of income of $20M/yr for a $2M per year maintenance cost. Our priority for technology that avoids waste is implemented by Toolkit Option T-7. without investment by us. Our Priority is for information technology".

"The information sharing network among the independent physicians for T-4 and T-7 will help us set up a management system for the whole universe. Does this tie the Independent Physicians together? T-8 is new technology testing. It's available. We need to optimally link the physicians together. A managed information system would work. PGMIS (Physician Group Management Information System) links the doctors, and other resources within the network, and other institutions and resources".

Partnering with Other Teams

The Legislature Team approached the table. They have decided to try and succinctly state how they can best affect health care cost through appropriations. They would like to try and put money into technology, the types of health care systems devices that will maximize the health benefit units per dollar for the quality of life and costsavings.

The FDA team approached. They discussed Toolkit options to decrease risk to patients and get faster information to the patients. They wanted to partner as providers. It became a policy issue. Several team members disagreed with where the FDA representatives were coming from. Integrity became an issue. The team eventually bought into their concept, but would not agree to funding.

An agreement was discussed with the HMO team to take excess capacity of patients. It would give them volume. Discussion pursued on how to prevent dumping of patients. It was a big decision to join with the patients or the HMO's. Patients won.

The team continued to provide treatment under the capitation plan. There seemed to be a lull in the activity of the players. They said they had implemented all of their strategies and were now minding their own business. They wanted to know what was the remaining things they could do to contribute to the rest of the game. They felt the actions by Congress didn't affect them very much. They discussed what they could do to cut health care costs. They had no feedback on the outcomes. They could only assume results. They will try to get information as it becomes available.

"The University and Labs approached the table to form a deal to collaborate with the physicians for information systems. They want 100K. This would support in a small way to help them go to legislation for appropriation. They want us to be a beta test site. Ask them to develop software to allow us to share among all independent doctors, secret encrypted data, about our patients. We can ship the data to help the attending doctors (if the patient was in a different state and needed treatment). Doctors are now able to share this data. This will allow us to share data for patient specific needs".

Patient Care

Patient Gerry Yonas was not happy with his treatment. The doctors were arguing over options of treatment. He finally got treatment. He offered to go to the insurance company to get the most ideal treatment.

Patient Amy Haas threatened to bankrupt the Insurers. Comment: "If the insurance company goes under, then we go under." We agreed to share the risk 50/50. 50 now and 50 next year. The Providers have taken the risk for patient Amy Haas. They negotiated the agreement with the insurance company to share the risk for the patient. Amy was asked if she would be willing to go public with her agreement, she said "yes." An advertising coup for the Independent Providers.

One of the patients who first approached the table for treatment and ended up going to the HMO table because the Independents were too busy reported "he died".
A lull in the Game stimulated proactive thoughts. "Are we going to do a patient incentive to stay well. What do we do as a group to maximize care for patients? Do we internally give each patient a report card? If we don't have patients, everything else falls by the wayside. You have to have a system that is the driving force. Motivation was to make money and protect our interests. When a patient came we treated them. We were lucky to have access to have the patients in our program. We gave them choice. Prevention money is there, for hip replacements, homecare, info systems, gene therapy, etc. We as primary providers, can study the general population and get a feel for the appreciation of these technologies. We need to have prevention of injuries, better education out there for the patients."

"Our core business is patients. If you miss peer review, you would last about three seconds."

"This is a private practice provider network. It will get us into prevention where we need to be. We could have the end provider be involved because you know your market, it's value added, it's in accord with our strategic initiatives. You can use insurance premiums. Lets do an agreement on system devices related to Geriatrics."

At this time the team reconvened to discuss the day's activities. They saw 15 patients and 2 sued them. They felt they achieved everything they set out to do. The team ended up with $1,324,700 Prosperity Game dollars. They spent 20K for lawyer's fees, and paid out 80K for the settlement on the insulin pump. They spent a total of 300K for Consortium's, AOL Agreement and Joint Ventures with the other teams. They also received 200K for payments from new technologies. The balance was from patient treatments.

FINAL PRESENTATION:
Independent Providers (Providers 1): Presented Ried Boom
Goals

Differentiate by:

- **Closeness of physician to patient**
- **More autonomy in decision making**
- **Independent multi-specialty practice**
- **More into capitation fees while maintaining patient control over choice of physician while preserving entrepreneurialship**

Strategies	Accomplishments
• **Max info systems**	• **T4, T7 PGMI's secure I.S.; AOL intelligent agent**

- **Waste avoiding technology**
- **Max home care**
- **Differentiate as first adopters**
- **Avoid anti-trust by preserving choice**
- **Relief from ins. reserves**
- **JV on accident reduction, national outcome data base**
- **AOL int'l agent to screen; b-test of home monitor**
- **Agreement with R&D, suppliers, FDA for first access**
- **Preserved choice by patient**
- **Obtained legislation**

Observations/ Lessons Learned

After creating new medical system, new information system, first access to new technology, home-based AOL screening system (for profit), and marketing for and caring for patients, we concentrated on business proposition.

- **Human-interface not in game, but large factor**
- **Complexity of biotech question convergence of focus/new patients**
- **Consumers weren't in life. Bring in real patient viewpoint**
- **Keep it simple**
- **Focus is high level need**
- **Stick to objectives**
- **Consider impacts (tech, ethics, etc.)**

New Model for Independent Physicians

- **Networked physicians**
- **Partnered with ins. company appropriately**
- **We got 90% of premium and assumed risk**
- **They handled marketing and distribution**
- **JV on information tech**
- **Access tocapitation dollars let prevention pay off**
- **Internal quality assessment and enforcement**

Providers 2 - HMOs

Strategic Planning

7 team members, 5 a quorum, majority rules
3 cards printed, triage, HMO provider 1, HMO provider 2. 3 team members would always hold these cards, incoming patients would go to triage and triage would assign patients to 1 of the 2 providers in the HMO group. (This failed in practice, cards were lost, no one could remember who was who, etc. However, patients were handled by whoever was available, or was collared by patient).

Team Challenges / Objectives

Goals: Keep everyone healthy: Provide appropriate and responsive care: Maximize market share

Team felt they accomplished these goals. I am not sure we maximized market share; it was very difficult to tell; no one knew how many patients there were, what the other team was doing, what percent we had. We did work to keep all healthy and bought appropriate technology.

Highlights

Team really did try to play the game and take HMO role.

Insurance contract signed early was disastrous! Many of our team thought they would get monthly premiums from insurance company + the money specified on the card for each treatment. I even asked them, twice, to be sure they knew what they were signing and each time they said yes, we keep the treatment $ + the ins. Then control said NO, you get only the monthly premium and must treat all comers. In effect, the HMO was the insurer and provider, the insurance team was simply taking money off the top, for nothing. (They were supposed to bring us patients and provide support money for us, in addition to paying for treatments specified on cards.)

Even when the disaster set in, the HMO team tried to work out agreements with insurers so that HMO could stay solvent, but they felt that insurers were totally unresponsive.

There was a “lull” in the afternoon; HMO team was just sitting, thought they had been “had” by insurers and couldn’t get out of it. No customers were coming, nothing to do.

Finally HMO decided to bypass insurers and go straight to consumers--then the game picked up considerably. Even though HMO was told we couldn’t treat patients on one-on-one basis, provider 1 team sued us for using THEIR treatment, which we were told was approved and available for use, and insurers were going to sue us for doing their job. This got real interesting; patients started coming to us because we cut costs and provided quick treatments, and they didn’t have much bureaucracy to deal with.

There was little incentive in the game to buy technology because there was little indication that it would pay off in the long run--especially when it appeared the insurance team was getting all the treatment $ and the HMO simply got a monthly stipend. The only time the insurers paid us was when they had a patient who needed a $100K treatment, then they brought over the $44K payment and told us to treat the patient.

Conclusion of some players was that technology was not the dominant issue, it was how to use existing technology appropriately, and then very carefully focus on what additional benefits could be derived from specific new developments.

What worked well

Astonishing complexity and confusing aspects of health care system in general was displayed. Confusion of patients, insurers, providers, legislators, well illustrated. Money was much better than in prototype. Toolkit was much better. Step by step instructions on some processes.

What worked poorly

Insurers Difficult as one team tried to serve both private and HMO providers. "Deals" to one team were secret from other. Insurers passed all risk to HMO. Two teams are needed--or none.

Incentives Many of the good things that the HMO wanted to do had no economic benefit to us, thus many of them were not done. I think teams need metrics. We had some metrics ($) for patient treatment, but none (or at least a very loose coupling) for new technology. We must have coupling from actions to results.

Other groups HMO had vague idea of what other teams were doing, most seemed irrelevant to them.

Money: it could and should be simplified. You took a great step forward from prototype by scaling consumer $ to represent net from sick and healthy, now scale research to same $.

General Observations

In summary, there were lots of things we didn't know how to deal with, so ignored them. There were lots of things we could do, but didn't understand how or why, thus we stuck to caring for patients and making money and eliminating obstacles to this process. **This is probably much like real life.** I think metrics are needed; people don't know what to focus on. In game, without seeing all D/D cards they don't know what will help and what won't. They liked to look at long term cost/ benefit at right of card but finally realized that didn't matter in the game. Screening technologies no good in game. Prevention is no use in game. Why pick technologies? Is there an advantage? Is the benefit worth the cost? Other issues are bigger than technology. Many of these folks want to help people and don't want to mess with the money-insurer-govt. problems. My team was well balanced with HMO proponents, opponents, and don't care. Their real problem was how to match their real world wants with game. They wanted to win, just didn't quite know criteria. Money was involved throughout game, but was not object of game. Could we structure game with no money, and "do good"; or have money be dominant and be only measure of success?? I think this is a very difficult game to structure and think you did great job of modeling it--but it's not perfect.

Thursday, November 2, 1995 Some Flip Chart Notes

Vision:	Integrated Staff Model HMO in academic medical center
Mission:	1. Keep everyone healthy 2. Provide responsive appropriate care to those who are sick 3. Solvent Strategies
Objectives	Lowering Cost through prudent use of technology Foster and promote innovation Collaborate with others to leverage resources Maximize market share through effective communication Risk Management Prevention wellness, holistic, customer focus Compete for patients - yes

Decision Making 3 of 5 Initiatives

Patient Handling Triage Provider A Provider B	3 each (3 x 5 cards)	1. Center for "Zero-Error" 2. Center for Appropriate tech use?

HMO Marketing

Provide continuum of Care	Wellness Program
Prevention	Gym
Primary - Tertiary	Weight Control
Provide Durable Medical Equipment	Smoking Cessation
Employ all available and developing technology	Stress Management
One-stop shopping	Adhere to Clinical Prevent
Diagnostic	Services guidelines
Therapeutic	

Define	Advantages of HMO Like Mayo One Stop Shop Satellites for convenience	Define	Benefits Package (with marketing)

Comments given at the end of the sessions on Thursday

What were your goals and strategies?

Keep everyone healthy; Provide appropriate and responsive care; Maximize market share

What did you accomplish?

Rebounded from disastrous insurance agreement; Helped fund and develop important technologies for HMOs; Killed insurance company; Irritated Provider 1

What did you learn?

Need legal advice before signing contracts; Need to market yourselves - don't depend on others; Need defined and competitive benefits package; Stay focused

General observations and summary:

Information is critical; Initial conditions unrealistic - no healthy patients; No return on technology investment during a session; Hard to focus on technology

What would we do different:

Define roles and responsibilities; Define benefits package early; Retain lawyer for contracts; Better understand roles of other groups; Go to Venture Capitalist early; Have real Venture Capitalist at meeting; Have real Insurance Representatives at meeting; Develop legislative agenda early and lobbying agenda; Require Independent Providers to stay independent

Friday (morning), November 3, 1995 Flip Chart Notes

ISSUES VOTING

3) Keep people health - wellness
3) Systems for health promotion
1) Appropriate Use and expectations of technology

2) Information gathering re: Health Practices
1) Shared Decision Making (Center for)
2) Telemedicine
2) Universal Access Consumer Information System
2) Behavior/Compliance monitoring
3) Incentives for healthful behavior
4) Chronic Major Health Problems
1) Analytic Systems (Lacking)
4) Assistive Technology
5) Public Health/Environmental Health
Mental
1) Appropriate Use and Expect of tech
Shared Decision Making and Lack of Analytic Systems

FINAL PRESENTATION:
Providers 2: Presenter: Fidel Davila

Goals & Strategies

- **Thoughtfully represent HMO**
- **Achieved mind set**
- **Crush the competition!**

Accomplished

- **Integrate technology with core provision**
- **Consumer focused technology**
- **Crushing the competition**
- **Getting sued**

Lessons Learned

- **Technology by itself has no intrinsic value**
- **Technology is a tool**
- **Technology has to be driven by end-users and customers need**
  - not go in search of problem
- **Focus, focus, focus**
- **Planning, collaboration**
- **Great facilitator (Don) and recorder (Connie) are essential**

Observations/Summary

- **Game works, except for no healthy money**
- **Be proactive - not reactive**
- **Hard to focus on technology**
- **Retain lawyers for contracts**

Quality cannot be measured - because it becomes Quantity! - Only indicators of quality can be assessed.

Insurance Payers

Players:	Staff:
Mike McCoy	George Allen, Facilitator
Flora Jane Moorman	Bryon Cloer, Analyst/Recorder
Bruce Patterson	
Jeff Richards	
Leonard Schlessinger	

This team enjoyed working together and in my opinion had the best functional group dynamics of any prosperity game that I have been a part of yet. The major weakness of the team was the lack of "heavy-duty" insurance experience. They chose to work as an insurance association rather than dividing into two competing groups. In my opinion, you need two physically separate tables if your goal is create competitive teams. This team never really had time to understand the legislative allocation and thus did not really construct policies that took this flow of money into account. The fact that they nearly went bankrupt and the lawyer (patient -Shives) lawsuit had major impacts on the decisions of the team since they were surprised (traumatized?) by these events.

Wednesday Night

1. Question: How can we establish Policies if don't know D/D Card costs?
2. Discussed Strategy and Challenges:
    - What if drop name "insurer"? since really are an arranger for negotiated fees
        -- e.g., House insurance - homeowner doesn't expect the insurance company to pay for painting, upkeep, etc.
    - Insurance group should emphasize outcomes and health services research
    - The group should create new products and options
    - The group considered themselves as an outdated group in the context of the Game
    - The group believed that they would have access to outcomes data to "sell" the Providers Teams
3. Facts:: Los Angeles: 35% uninsured
    - UCLA focused insurance on populations
        - e.g., Special policies for Amerasians with relatives in LA, Hong Kong, and Taiwan
4. One player doesn't believe proposed preventive measures will have a place in the Game
    - he also believes that preventive options should be fundamental drivers in the Game

Thursday Morning

Session 1

Summarized points

- Are we (insurance) obsolete?
- What is our value-added? Our "unique selling proposition"?
- Consumer choice
- Alternative medicine & wellness
- Health promotion
- How do we offer unique policies given our Game time limits

What are we? Dr.McCoy to come up with our vision and strategy tactics

- Who are we and what is mission?
    -- best source of provider and patient info
    -- spread the risk - provide access
    -- the means for access - make it possible to bring together services i.e., broker H/C services

-- goal: universal
-- Privacy & ethics

- Discussion
  -- how view? everyone gets sick & thus everyone needs care versus some get sick longer/shorter
  -- Can the insurers buy selected care deliverers from the Providers' teams but will consumers come to us (insurers) for health care?

Mission
1. Promote health rather than deliver care
2. Provide value

Strategies
1. Universal access to H/C services
2. Driving outcomes quality & cost-effectiveness benchmarks
3. Perform H/C Product development Tactic - customization
4. Keepers (best source) of provider & patient information brokers
5. Be the market leaders in ethical & privacy management
6. Consumer advocates for their customers

NOTE: - Team thinks that they will lose if they have to go head to head with HMOs
-- they can hire their own doctors from the other groups if they want to

Tactics
1. Managed Care only
2. Dual option: - managed care
   - fee for services
   - extreme personalization(individual - customer)
3. alliances with providers
4. reduce cost
5. target healthy / high profit
6. MSAs (medical savings accounts) for employers, suppliers,
7. Alliance with legislators
8. Establish center of excellence * some enabled by telemed
9. Restructuring of provider environment - ancillary services -
10. mental health care
11. take political mandate and provide best tools defining success measurement

Laws
1. providers - practice by telemed in any state - no state boundaries
2. civil penalties - for misuse of private data
3. government shall set standards
4. tax credits

Senator Pam Hanlon visit to the Insurance team -> "what are the Insurers strategies for legislation?"
- Hanlon: partnership dollars for Toolkit options?
- Dr. McCoy : legislation to be the brokers/national repository for measures/standards

Note: the team does well with high level tasks but not lower-level tasks

Potential Toolkit Options to be selected by Insurers:
T1, T4 - personal healthinfo systems
T7 T8 - key area - outcomes
T24 & T25 - hometelemed
T59 - education

George Allen suggested the Team consider breaking up into subgroups in order to accomplish the tasks required for the Team (~ 9:30am).
Subgroups:
1. consumers policies
2. Toolkit options
3. negotiate with other groups

Mike - close deals with HMO providers
Leonard - MSA policy plans
Jeff - independent provider & lobby
Bruce - lobbying
Flora - Toolkit

Team dynamics: A player unfocuses the Insurance team with high level discussion
Another player got the group to take tasks to be completed

4 Policies were developed:
1. MSA (new)
2. Option 1 - Independent
3. Option 2 - HMO - private
4. Public Health Plan - government

Session 2
Insurers submitted Press Release
- Promote health and provide value
- Comprehensive agreement with HMOs reached
- Vigorous negotiations with independent providers
- Insurers will drive benchmarks to quality and cost-effectiveness
- Leaders in privacy, product development, and best source of patient & provider info

Bruce - established agreement for Haas treatment with Provider 1
- $70K paid in this session, $70K next session
Note: The Insurance Team cheered Boyce's battlefield death since it allowed team to stay in business

Session 3
- Insurers team owes $70,000 for Haas
- litigation: Shives suing for $100,000,000
Discussed litigation with lawyer Marks
- $100,000 settlement
New Policies
* Group 1 Option
* MSA Option
* HMO Option

Note: Problem with Game is that it does not simulate the volume of patients as in real life

Suppliers discussed development of data assurance; interface design
- suggested $1M; agreed to by Moorman

A player comments
- The Game distorted goals of health care to value and price
- any commitments are going to fail
- can't educate on health care - can announce on microphone but won't do any good

Lawyers Team - announces that someone's going to jail unless willing to settle
- Jeff Richards went to trial.

Some Providers requested info on malpractice insurance - all insurers at trial - no one to counsel
Amendment to HMO pact: $45,000 stop loss assumed by Insurers

Session 4

HMO Policy nulled by Dr. Davila since insurers were not able to steer any business to HMO Team
Government regulations required a simple indemnity plan for government insurers

Government allegations- requested information on quality of service
Provider I requested malpractice insurance information
Team received $174,000 from legislators but no government buyers of policies
Vehement complaints from 3 team players that insurance concept in Game was inadequately designed
Gov precluded Team from offering terms that the HMO Team was allowed to provide

- Lawyers stated that HMO Team should not be allowed to collect premiums for patients since don't have a license
- Lawyers : industry alliance to Health Insurance Commission
- retainer: ~$50,000 & if successful get patients back
- Young: sue HCFA since gave arbitrary stipulations that could not service gov employees yet HMO could deal with gov employees directly
- Marks: (1) hire group of attorneys to request info from HCFA- forced to provide inferior policies; exhaust admin remedies
: (2) go to State Insurance Commission that HMO not licensed
- Young: ". . . if providers bypass insurers, must abide by state insurance regs" - legislation signed by President - thus, go to Control Group to determine if abide by regs
- Schlessinger - HCFA regulator made a statement restricting Insurer Team from offering policy terms

NOTE: Insurance Team Strategy Summary:
Session 2 - Team assumed risk and lost $
Session 3 - Team made agreements with HMO & Independents shifting risk to Providers and recovered $ lost in session 2

Summary Comments by Insurance Team:
* High-level re-engineering of Insurance industry focused on consumer needs
- Game doesn't allow significant insurance - relationships to be modeled - e.g., outcomes must be appropriately modeled & provided to Insurers
-- Game didn't handle economics correctly: HMO - health care $, no incentive to handle correctly
-- legislator team: were they federal, state?
-- Insurers spent most time in trials/inquiries
* Led in the appropriate investment Tech Options and appropriate alliances;

- Game couldn't accommodate correct investment - those providers could charge more
* Couldn't show an outcomes difference between providers service
- too much time spent in litigation / inquiries
- no feedback of options allowed in Game process
* "We could have been left out of Game & it wouldn't have mattered"
* "This Game so slanted that doesn't provide good basis for Roadmap inputs"
* The value of this Game was the team building and problem solving process; valuable for developing the real Roadmap
* No knowledge base; financial risk areas; the Insurance team (also the smallest team) was overwhelmed by Game requirements
* "We could implement this over the Internet; developed relationships required
* Accounting should be separated
* Insurance companies in business there to make $ as well as providers
* Should have emphasized what the patients' education requirements should be
* "Policies should be more like reality"
* Game should have more than 1 table of consumers
* Team should have had health and happy cards promoting prevention - e.g., stop smoking, etc.
* Do you feel that this experience helped in addressing tomorrow's Roadmap? Doubtful
* Game provided no way to get the benefit of investment or efforts

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FINAL PRESENTATION
Insurers' Summary

Insurers' Mission

- **Promote Health**
- **Provide Value**

Insurers' Strategy

- **Assure universal access to healthcare**
- **Serve as advocates for the consumer**
- **Drive benchmarks to quality and cost effectiveness**
- **Perform healthcare product development**
- **Be best source of patient and provider information**
- **Be market leaders in ethical and privacy information management issues**

Proposed Insurer Tactics

- **Establish centers of excellence**
  - **— telemedicine-enabled**
  - **— intra-region**
- **Provide increasing choice**

  - **Managed care**
  - **Fee for service**
  - **Medical savings accounts**
  - **Extremepersonalization options (e.g., policies of one)**

- **Make alliances with providers**
- **Implement cost reduction actions**
- **Target healthy/high-profit customers to offset universal access losses**

Insurer Accomplishments

- **Operated payer system (sold policies, paid providers)**
- **Started high-level re-engineering of insurance industry**
- **Comprehensive look at consumer benefits**
- **Developed tool kit options and led in supporting appropriate technologies**
- **Issued press releases/formed alliances/stayed out of jail/avoided bankruptcy**

What we learned/observed

- **Game setup did not understand insurers**
- **Economic incentives in game are not right**
- **Insurance industry more complex than modeled**
- **Positive "outcomes" and Toolkit results were not fed back into the game play**
- **Litigation was highly disruptive to service provision (real life?)**
- **This game would not have changed if insurers went away**
- **Team could have used more financial risk assessment experience**
- **System seemed hostile to insurers' goals and re-engineering**
- **Profit requirement was not explicitly listed in game challenges**
- **Team responded to overwhelming risk (losses) in the second session by transferring risk to others**
- **Bigger pool of consumers needed**
- **Lack of healthy consumers skewed insurer actions**
- **Focus on technology was not possible for insurer team in part because of lack of feedback in game from outcomes technology improvements**

InsurerRoadmap Issues

- **Outcomes Information Technology**
- **National Medical Record System**
- **Consumer Integration into the Information/Education System to Make Them Agents of Change in the Evolution to Chronic and Preventive Healthcare Management**

Legislators

During Session 1, we divided our discussion into Process points and Content points. This session occurred Wednesday night, after dinner. Process points concerned three areas:

a) Assigned roles. We decided that the team would be Federal Legislators only, taking the State's interests also into account. Each Legislator was assigned to a team to be the liaison the following day.
b) How to handle visitors, lobbyists, etc. We decided on a proactive, rather than reactive, approach. With our liaisons to the teams prepared to go "visiting" early on Thursday morning, we hoped to show a genuine interest in the constituents. If another team visited us, they were to speak to the assigned liaison.
c) Decision-making procedures. We decided to use a majority vote after discussion and a brief one minute go-around before the vote.

Content points during this discussion concerned three areas:
a) Challenges to be addressed by strategies tomorrow. The main challenge was agreed upon, and was to be typed and prepared for AM session. The challenge focused on this:

> "To maximize the present value of health care benefit per dollar invested. Health care benefit is measured in units that are a product of length of life and quality of life."

b) Toolkits. Three legislators were to research the Toolkit options, coming up with recommended general categories for Thursday morning. The first liaison visits to the other teams would include a sharing of these categories we saw as addressing the challenge above.
c) Other homework for the night. Prepare and anticipate unexpected events. For example, one legislator came the next morning with a plan for putting $$ aside for catastrophes during the game, which we did. Other homework was for two legislators to prepare bills to be passed that address our challenge.

(2) Highlights of the Game: This proactive stance of the legislative team had advantages and disadvantages. The early visits by the liaisons were met with distrust and surprise (most of the teams had nothing prepared to share with us). The continued visits resulted in some collaborations on Toolkits, but only on the teams who trusted our desire to take the constituents thoughts into consideration as we passed laws and bought Toolkit options. The legislators announced bills we were putting into place, and tried dialoguing with the teams. That also had disappointing results, as most teams were barely interested, busy with their own brainstorming. This proactive stance continued throughout the morning. The "idealism" wore off as the legislators noted the distrust and frequent statements like "we don't have time for you". What worked best was for the liaisons to sit and listen to the teams discuss their issues and glean what they could.

Since we had decided to use information from the liaison visits as we made decisions about appropriations, it was difficult since the teams did not give us too much information. Appropriation decisions were made arbitrarily, trying to keep in mind our challenge.

The legislators tried to provide the accountability function, asking teams that received funding what they did with it, and asking for reports on projects. That also received a half-hearted response, frustrating the legislators who had hoped to use that information for further appropriations decisions.

The second part of the day proved to be more reactive than proactive for the legislator team. We were being approached to support or fund some of the major efforts taking place, and we were able to do that as we were already "on board" with those projects from our close contact with the teams as they were developing.

(3) General observations:
a) There is a "fog" in the legislative process, because of time constraints and personality pressures.

b) It may have been unrealistic to try to model a proactive stance to our constituents, hoping the private sector would follow. This effort was met with distrust and sometimes disdain.
c) Bypassing enabling laws and providing funding to prompt them, we had hoped to drive policies and partnerships. We didn't have time to see the fruition of those, even though we tried to encourage accountability to us.
d) Since Marshall and Pace stressed during the briefing that certain teams can "win" and "lose", our team pondered that challenge and felt that we had won because we addressed our challenge and attempted to work with constituents.
e) Could it be because of our demonstration of a government that "cares" that the third day had no takers for the legislative roadmap table?

We all agreed that we benefited enormously from this game. We got an idea of the government's struggle to legislate in the health care arena, and received a clearer picture of the players/challenges that affect the decisions. Conflicting personalities did not evolve as a problem, probably due to the pressing decisions that had to be made. The game format allowed us to experiment with decisions and feel some of the results in a safe setting.

11/2/95
8:26 am

Congress, in a late night session, passed three laws to help improve the use of technology in the US healthcare system and debated 2 other proposals aimed at achieving even greater efficiency in the system. The laws passed are:

(P) 1. HC Providers: If licensed in any state, provider can practice via telemedicine in any other state.
(P) 2. Confidentiality: Civil and criminal penalties for inappropriate use of patient care data.
(F) 3. Tax Credit: R&D credit for technology partnerships.
(F) 4. Medicare: Health Care Finance Authority (HCFA) reimbursed for C-to-C telemedicine.
(P) 5. Standards: Government as largest purchaser of healthcare--shall adopt for itself (HCFA, DoD, IHSS, VA, FDA) standards for health data exchange.

The two laws currently under debate are... 2 and 4.

CONGRESS ANNOUNCES OVERARCHING HEALTH CARE INVESTMENT STRATEGY

11/2/95
8:55 am

Congress today announced an overarching strategy for investing in greater health benefit for the American people. The health care investment strategy applies to congressional health care policy making, spending and related legislation.

The strategy is to maximize the present value of health care benefit per dollar invested. Health benefit is measured in units that are a product of length of life and quality of life.* Quality of life is multidimensional and quantifiable, embracing physical status, functional status, psychological status, self-care, social interaction, and other attributes.

That is, Congress seeks to support those programs, services, technologies and initiatives that render the greatest bang for the buck, where bang is units of health benefit for the American people.

Congress intends that determinations of health benefit and cost be *a priori*, neutral with respect to any particular disease, age group, or other demographic, social, or economic characteristic of Americans.

Congress recognizes that measures or indices of quality of life and methods for determining costs and related economic aspects are imperfect and subject to ongoing development. Therefore, Congress is committed to supporting, in the public and private sectors, continued advancement, i.e., development, use, and evaluation, of the tools and resources needed to improve determinations of health benefit and cost. This includes, but is not limited to support of advancement of quality of life measures; outcomes research; databanks and registries of clinical trials, post-marketing surveillance and other studies; economic methods and analyses; and access to these. Congress specifically recognizes the importance of incorporating the preferences and utilities of patients and other consumers into determinations of health benefit.

Notwithstanding imperfections in determinations of health benefit and costs, Congress will make its policies and resource allocation decisions with the best available evidence. From year to year, Congress anticipates an increasingly well-founded base of information upon which to make its policy decisions.

Thus, in making policy decisions, Congress will be guided by answers to the question: Does a given policy, individually or together with others, and relative to its alternatives, yield a high product of length of life and quality of life per dollar spent?

*Health benefit units (HBUs) are analogous to, yet an improvement upon, such measures as quality-adjusted life-years (QALYs), disability-adjusted life-years (DALYs), and healthy-years equivalent (HYEs).

CONGRESSIONAL APPROPRIATIONS PASSED FOR 1998-1999

In keeping our commitment to investing in better health for the American people and supporting programs, services, and technologies that render the greatest bang for buck, Congress announces a MAJOR new commitment to Industry and University-based research.

We have doubled funding to $5180 for the various planning and funding organizations. Of this increased level, $2660 is reserved for university-industry consortia. These consortia will receive grants on a competitive basis--from federal agencies and will be required to meet cost sharing requirements.

Congress approved a 1/2% increase in the growth of Medicare and federally funded insurance for a total of $174,640.

Congress is maintaining level funding for FDA ($180) - a considerable concession to the agency in this time of severe budget cuts.

CONGRESSIONAL APPROPRIATIONS PASSED FOR 2000-2001

Congress passed its FY 2000-2001 appropriations. Budget was frozen at previous year's total of $180,000 due to downturns in the economy. Congressional funding allocations are as follows:

Insurance was cut slightly to $174,438. A special legislative session was called to approve 3 new insurance plans for Medicare and Medicaid which will reduce the allocation by $74,438 due to cost savings.

$27 was added to FDA Budget to ensure that the FDA fully implements policies P8 & P9. Their total budget is now $207.

The allocation to Planning and Funding Organizations was increased $175 to $5355. Of this amount, $40 is available for supporting existing standards development organizations to enact standards for Medicare and Medicaid transactions consistent with the previously passed law regarding health data exchange. $45 is allocated for health benefits units and cost determinations. And $100 was included to begin design of a secure information infrastructure for a health information exchange.

Planning and Funding is to provide the legislators a report next session regarding their plans for implementation of the above allocations.

PROPOSED LEGISLATION

11/2/95
1:55 pm

Attorney draft at request of Providers 1 and Legislators

The Legislature wishes to clarify the following:

Providers that contract with insurers to provide medical care to an insured population are not subject to state insurance laws or regulations (and their capital reserve requirements) insofar as the insurance companies have already complied with such insurance law requirements.

However, provider groups which bypass insurers and contract directly with consumers to provide medical care must comply with state insurance laws.

PRESS RELEASE

11/2/95
2:30 pm

The federal legislature has called a public hearing for the purposes of receiving testimony on APPROPRIATIONS for past and upcoming fiscal years. The hearing will convene at 2:35 pm today.

The legislature expects to hear testimony from:

A) The FDA
B) Universities, Labs
C) Planning and Funding organizations

Each entity shall discuss:

A) How previous appropriations have been spent and how such spending is consistent with previously announced goals of Congress;
B) Plans for spending future allocations in manners consistent with Congressional intent to maximize the present value of health care benefits.

CONGRESSIONAL APPROPRIATIONS PASSED FOR 2002-2003

Insurance - $174,000
FDA - $208
FundingOrgs. $6640

From FundingOrgs the following funds are earmarked toniv/labs:
$100 for Patient Education
$100 for Information security/data encryption
$100 for Acoustically based screening
$100 for Outcomes database, clinical trials, best practices guidelines

Congress will provide financial support for the development, implementation, evaluation, and dissemination of methods, tools, and related analytical resources to determine health benefits and costs associated with health care programs, services, and technologies. Financial support in the amount of $45 per year, will be appropriated to the funding organization, which will allocate this in the form of direct support, matching funds, and other means, for government agencies, academic institutions, private sector groups, and consortia of these.

Congress has passed and the President just signed into law two pieces of legislation aimed at improving FDA review of new technologies and making it easier for health care providers to form health care networks.

The first law -- New Technology Review - puts realistic time frames on FDA review of new medical devices. Under the law, the FDA is required to reduce review time for "brand new" technologies - known as "Pre-marketing approval devices" by 25% and to reduce review time by 40% for "510k" or "substantially similar devices."

To ensure patient and consumer safety, the FDA is required to increase its post-market review of devices to detect and quickly act upon adverse event. The legislation also expands Medicare reimbursement of experimental medical devices that have met FDA approval for chemical trials.

Other legislation signed into law today clarifies insurance laws for provider groups to help these individual providers join together to make health care more accessible.

PROPOSED LEGISLATION

11/2/95
Signed by PresidentBerman at 3:32pm

The Legislature wishes to clarify the following:

Providers who contract with insurers to provide medical care to an insured population ~~and~~ subject to state insurance laws or regulations (and their capital reserve requirements) insofar as the insurance companies have already complied with such insurance law requirements.
However, provider groups which bypass insurers and contract directly with consumers to provide medical care must comply with state insurance laws.

Biomaterials Liability Limitations Act

11/2/95
4:50 pm

Congress places upper limits on the punitive liability of biomaterials supplier companies of injuries attributable to biomaterials of $1 million per plaintiff and $1 billion per defendant company for a particular type of injury.

FINAL PRESENTATION:
Legislators: Presenter; Pamela Hanlon

Goal

Maximize present value of health care benefit per dollar invested through the government process.

Strategies

• Passed enabling laws early on to reduce barriers and create an environment which encouraged the market to develop
• Fulfilled accountability responsibilities
• Create a workable governing process
• Assign liaison to each constituency
• Developed Toolkits early
• Put priorities in line hoping private sector would follow and international community would follow
• Streamline FDA process (in response to constituents)
• Enabled physicians to form competitive models
• Long-term investments supported prevention, education, data base info system

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What Did We Learn?

By interfacing with constituencies,
• We need to rely heavily on constituents for legislative decision
• Importance of oversight and accountability to detect system imperfection

General Observations

When we provided the right incentives the system worked to benefit consumers, providers, payers.
When we didn't apply the oversight, ...
The game journey with a shared vision was FUN!!!
We would have preferred more time to see effects of our laws.

Suppliers/Manufacturers

Strategic Planning (Session 1): In general, we did not accomplish much in this session since all players and the facilitator and analysts were not experienced in the game. After the fact, we would now encourage various decisions to be made - like decision making mechanics. Although this was suggested, the group didn't know how to structure this effort until we lived through the mechanics of the game.

We did think about what would be good for the health care industry and we did some market driver analysis. The things that were accomplished were: we prioritized the challenges; we brainstormed the technologies that would be useful; and we did market analysis, such as interviews, D/D patient card analysis, and market feelers. We never worked the team dynamics and decision making process. We did, however, decide that the team would work as a consortia (this is probably not the case in the real world when developing medical technologies). We discussed marketing analysis and how we might use this information to direct technology development (this was done using an electronic version of the patient cards and Excel; it might by useful to make this information a standard part of the game). In addition, we decided to focus on high volume sales to make a profit. Since profit became a driver, we developed a list of technologies that we could sell which were: products that focused on the detection and treatment of heart disease, cancer screening, orthopedics, implantables and replacement parts. The group wanted to work on early detection and prevention vs. response and treatment therapies.

In addition to the above activities, we were visited by each of the interest groups to discuss their interest areas and what they felt was needed to improve health care. This process in conjunction with the legislature announcement influenced us to focus our first products in the area of home health care and telemedicine. We came to the conclusion that telemedicine would be a great focus (we came to that conclusion not from any real analysis, but from the belief that it would be a hot area. It did not help that the legislature passed a bill to support telemedicine at the start of the game. I believe that this created a focus that may not have been real from a technical viewpoint). So this identified which Toolkit options were critical for our product line, and they were T4, T7, T8, T24, T25, T26, T27, T31, P6, and P8. We thus reviewed the funding board supplied to decide where we would invest our financial resources to assure that the home health care products made it to market. From there, Steve Dawson, really provided the product development line for the consortia.

Challenges and Objectives: We ordered the challenges from the players' handbook into the following: 1) Develop and sell technologies; 2) To make a profit; 3) Protect interest through negotiations and Use influence to change laws and policy. We set a goal of improving health care quality while making a profit. In review of the game, we felt that we met all of these objectives to some extent.

In the area of developing and selling technologies, we developed two product lines for home health care, we developed cell cultured replacement organs, an RF cancer treatment device, and we supported bio-genetic makers for cancer detection. In the area of profit, we made a conservative approximation at profits from our developments. The approximate amount was $4 to $8 billion. In the area of protecting our interest, we probably did our worst at meeting our goal. For example, we were able to give 50% of our profits on the cultured cell organs to the funding agency (poor contract wording)! The final area was to influence policies and laws, which we felt we did successfully.

In development of our strategies, we thought that we would review product lines and then look at what happens as time goes on to see what technologies are needed. In actuality, we never followed through on this. There were several reasons why this was not accomplished. One important reason was that there was

no mechanism to provide the necessary profit feedback needed to direct decisions. (There may be a need to network the analysts' computers and provide a mechanism to enter data and review data in real-time from the team tables. These data should include laws that have passed, things in the works, profit feedback, funding availability and requirements, as well as other information. This may be done using the http: or WWW mechanisms. This could allow the review and analysis and synthesis of information to occur at a much faster rate.)

What Worked Well in the Game? They learned the problems of other business players in bringing technologies to bear on health care quality and cost. We felt that the interplay of teams and the time required to address issues probably more realistically modeled the real-life movement of information.

Showed interactions and thus may have helped change perspectives that would not have occurred prior to playing this game. This means you may have gotten better results from asking personal opinion information following this type of activity vs. getting it prior to the game.

What Needs Improvement: We felt that the task at hand was for the suppliers to act and operate as a business would in the real world. There needs to be mechanisms to simulate the performance of market analysis to support decision making, to provide profit feedback in support of product development and marketing decisions, and a tool set (business policies and procedures) to guide the activities of the group.

We would suggest that a set of tools be developed for the suppliers to support the game. One suggestion is the development of a checklist of activities needed to be accomplished by the suppliers to bring a product to market. This would have better represented the problems that we were about to face, focus energies on the business aspects rather than on the mechanics of the game, and thus provided a more realistic set of inputs for the roadmapping efforts. The rules for the game need to spell out the following activities and what the required game actions are. Some attempt was made in the players handbook but it needs to be much more specific. The list seems to be:

1. Develop product description - Should include cost information - expected costs to bring to market and expected cost to consumers, and profit margin
2. Identify technologies needed - Write description or choose from Toolkit options, suggest costs to obtain 50% chance of success.
3. Develop technologies - Get control team to agree to roll the dice for a fee
4. Obtain license/patent - Work with the lawyers - pay fees
5. Identify FDA requirements for consideration of approval - Work with the FDA to understand possible requirements
6. Build product - Should require description of facilities required, production costs. Should have to pay the control team for production costs
7. Conduct testing/ trials - Should be required to pay someone for this and take results approved by control team to FDA
8. Obtain FDA approval - We think this means only negotiations with FDA
9. Announce product availability - Need a mechanism for assuring the team that this is now impacting health care!

In addition, a more automated means to play the game is needed. As stated above, the use of a networked set of tools to allow a faster interchange of information would allow the information to keep pace with the game. A good example is the news updates that occurred throughout the game. They took several minutes (as much as 10 min.) for the readers to present the information. In real-time, this would be equivalent to taking about a week to a month to get information out. For a fast paced game like this, that is not really acceptable. Also the mechanics of the game occupied a lot of the compressed time. For instance, in a 2

hour block of time where 2 years are covered, the speeches from congress, the radio ads, etc. occurred in non-compressed time. That is, reading press releases and listening to announcements used real time units, while the game actions were occurring in compressed time units. Since these were important for the role playing efforts, more time needed to be allotted to allow for the technology insertion activities.

General Observations: We noticed that the providers and Universities/Labs were developing and bringing to market products. In the real world, this really does not make sense. Although the providers do produce products, they are developed with a limited technical staff and have a tightly focused application environments that actually would increase total health care cost. This cost issue was not modeled in the game.

I think that university and labs do not bring products to market. They are more of a technology transfer organization and are not equipped to handle the business issues and legal issues to bring medical technologies to the market. This was also not modeled in the game.

Due to the compressed time scale of the game, one could not view the interplay of the environment long enough to make a tie back to the needed technologies for future development. This is part of the reason that some technology areas originally identified as possible areas for roadmapping were never brought up in the issues from the teams on Friday morning. Although it then seemed appropriate to drop these from the discussions that day, there was a cry from some of the participants that they had come to discuss these areas and they felt that these would be important technologies in the future of health care. (Of course, you responded and then placed all of these in an other technology topical area. There was a large group at that table too!) In the sense that the game was supposed to draw out which technologies should be roadmapped, the game was not a success. The participants got a lot out of the game but it clearly did not meet this objective which is why your feedback stated that your objectives were not met. The game needs to be run for a longer time in order to allow more technologies to have been considered.

The game was supposed to be aimed at technologies that would improve health care quality and costs. However, there were no metrics with feedback in the game to measure at all the effectiveness of technologies in improving health care! The details in the game provided an excellent way to understand the environment in which technology is brought to market and thus the group did get an excellent insight into those issues, as pointed out by the participants. But the game needs to have feedback throughout the events about the effects of new technology on cost and quality! Most people were quite disappointed that there was no feedback from the control team on what the game results were - which technologies were developed and what the impacts were on cost and quality! This would have provided a better framework to entering the roadmapping activity.

FINAL PRESENTATION:
Suppliers: Presenter; Steve Dawson

Goal

Improve health care delivery and save lives while making a profit.

Supplier's Strategies

- **Form a consortia for diversification flexibility**
- **Market intelligence to determine our technology investments**
- **Form relationships with university and labs to leverage funds**
- **Formed relationships with providers to work on policy**

Supplier's Accomplishments

- **Market intelligence → Home healthcare**
- **Cell cultured organs**
  - **funded by alliance with univ/labs - federal funds**
  - **providers, labs, suppliers → P6, P8**
- **RF cancer treatment**
- **Bio-genetic markers**
- **Alliance for standards and data transfer**

What Did We Learn

- **Alliances with labs/univ and providers were very useful**

- **Started with interest in preventive techniques but funding channels encouraged different business**

- **We needed to be more careful with details**

General Observations

- **Little relationship between game and the roadmapping activities**

- **Presentations from teams this morning were insightful**

- **No feedback about profits from investments was too unrealistic for the supplier**

- **Surprised by results**

US Food and Drug Administration and State Regulators

Facilitator:	Cecelia Williams
Analyst/Recorder:	Kathleen Schulz
Team Members:	Eloise Eller - Human Affairs International
	Linda Erickson - Sandia
	Sarah Hayes - LANL
	Dorothy Harris - ITRI
	Pat Johnson -
	Sona Kalousdian - American Medical Association
	Barbara White - FDA
	Gary Silbert - Lovelace Institutes

Strategic Planning (Session 1):
The team began informal strategic planning on the first evening of the game. They discussed tool kit options, with one team member providing some new ones for consideration. They made some preliminary decisions, to be finalized in Session 1: e.g., be proactive very early in the game, seek out and educate other groups about FDA to prevent misunderstandings that FDA is a roadblock, and express desire to work *with* other groups to facilitate approval process. This concept of partnership between FDA and other groups to facilitate the approval process was very strongly advocated by the FDA team throughout the game.

At the beginning of Session 1, some team members were especially anxious to start, and began to strategize and plan with their nearest neighbors before the session formally began. Some were feeling time pressure (e.g. wondering if they could quickly enough process/act on economic issues); some were concerned about how best to interface with the numerous other groups.

After some discussion, the team identified objectives in 4 key areas: Risk-benefit, collaborations, regulatory process, and information (related to the preceding 3 objectives). The team assigned pairs to each of the 4 objectives to develop strategies for each and conduct negotiations, etc. in each area for the remainder of the game.

The team initially tried to assign members' liaison responsibilities by (other) team name. They listed the other teams and tried to prioritize them in terms of need for interaction, but this proved to be a difficult exercise because the team discovered that FDA needed to interface with nearly all the other teams. To resolve liaison responsibilities, the team had to return to the 4 objectives and ask "who's primarily involved in this one?". Finally, 4 teams were identified as being priority for FDA interaction: consumers, insurers, suppliers, legislature.

Team Challenges/Objectives:
The team identified challenges for our healthcare delivery system in a thoughtful discussion of trade-offs in healthcare. They discussed numerous issues and challenges; these were then used to identify the 4 objectives which formed the basis for team play in the remainder of the game. The key objectives were:

- Risk/benefit tradeoffs: The team agreed the bottom line was to maximize benefit and minimize risk without sacrificing the American public's health
- Regulatory Process: The FDA team wanted to accelerate and streamline the process, while assuring protection of the public. (During subsequent play, this team committed to reducing time for approval by 75%.)

- Collaboration: They agreed teaming between developers of biomedical technology, universities/labs, insurers and consumers must be encouraged early in the process. ("They have a lot to lose if the devices fail...& they have big lobbies in Congress. We, FDA, don't.")
- Information: Debated FDA's role in producing and disseminating information, but agreed that FDA *must* accept more responsibility for educating submitters about the approval process, what and how to submit. They agreed this was essential to increasing efficiency of the approval process. ("That will decrease cost to developers of bringing new technologies to market."). The team was concerned with the time and effort required, of both FDA and submitters, when initial submissions did not meet FDA requirements.

Other issues/problems identified during the discussion: Underfunding/understaffing at FDA ("it's a small regulatory agency that has to serve the whole nation."); need for FDA to "work smarter" and expedite the whole regulatory process; lack of knowledge outside FDA of FDA's mission ("A fundamental question in our society--what do you want regulation to do? Protecting the public's health also means getting good new products to market quickly."); need for FDA to overcome the image of being an obstacle to technological progress--through improved processes and educational outreach; and a need to re-examine FDA's mission and our nation's expectations of FDA (recommendation: do so via legislative/regulatory reform). This group believed that funding levels for FDA vs. expectations need to be examined; restructure of FDA should be considered, and FDA's information management processes/systems should be reviewed (e.g. supply standard formats, etc. to submitters).

The trade-off between planning long-term strategy and being distracted by short-term issues (i.e. being drawn into game play) was a challenge that occurred very early in the game (~8:30 AM, Session 1). The FDA team got overtures from other groups (press, consumers, lawyers) almost immediately. The team solved it by scheduling future appointment times at the urging of the facilitator (*note:* the facilitator was key to keeping the team on track early in the game). For most of Session 1, the team struggled with finding the proper short- vs. long-term balance. Some comments during this phase:

"They're our boss. We have to talk to them now!" (Concern with setting future appointment with Legislative Team.)

"We've got to get moving....FAST".

"Can we pre-empt some of this strategy and do the toolkit options?"

Eventually, the team resolved this by completing what they felt was the most important part of the strategy discussion, then moving to consider toolkit options. They completed this expeditiously by setting time limit for discussion and narrowing the field by voting (to focus on 4 items: P6, 8, 9, & a "new" P12 option). Selection of these 4 options was relatively easy for the team; however, determination of funds to commit to each was not. Decision on level of funding for each was done after much team discussion, including participation by some players who had been reticent up to that point. They realized that allocation of $ was critical, not only for communicating FDA team's commitment but also for garnering support: "The other groups always ask 'are you putting money into it?'....If we're not, our 'support' doesn't mean anything to them."

By the end of the game, the team felt that their success was largely due to the time initially spent on strategic issues, and acknowledged the facilitator's key role in helping them to find the long- vs. short-term balance that allowed them to accomplish this.

Game Highlights:

This group was cooperative and collaborative from the outset. There was no friction or leadership/power struggle on the team. The team members were well qualified for this game, bringing a broad range of complementary experience and actively exhibiting a willingness to share their experience with the team. For example, one team member was an FDA employee who had extensive personal experience with our healthcare system, and had also participated in the prototype game. She came prepared (with hand-outs, etc) to educate the others with respect to FDA and its processes. One team member had game theory background, and was an industry employee currently assigned to Lovelace. Two team members had extensive, recent personal experience with the healthcare system (4 major surgeries each within the last 3 years). About half the team members had read the materials on arrival. Two had done homework on proposed strategies and toolkit options. Most of the other participants weren't really ready to begin the first evening, and were relieved to hear that they had the evening to prepare!

Key Insights:

Key issues in healthcare, from FDA's viewpoint were identified during the game:

1. The need to increase efficiency of approval process through partnering with technology developers/ submitters. The two main drivers for the team's strong advocacy of this position were: (1) submitters are trying to do the right thing, but often don't know how/what to submit and (2) FDA is overworked and cannot afford the time to "do it more than once". The team felt that FDA has a strong responsibility to inform submitters of requirements, but presently doesn't have enough time to do so. The team's position was that partnering would decrease repeat submissions, freeing up more FDA time to educate/inform submitters.
2. Need to work with legislators was also seen as key by this team. During interactions with legislators, the FDA team's position was summed up in this quote: "What can we (FDA) give you (legislature) to help you do your job?"
3. Team reaction to option to abolish federal regulation (via FDA) and turn it over to states: "That's horrifying to think of...e.g. NM doesn't even regulate some areas at all!"
4. The team observed that most of the toolkit spending was on technologies rather than policy options. They believed that streamlining the approval process couldn't be done if technology was emphasized at the expense of policy. Relevant quotes:

   "It strikes me that the current emphasis is on 'how to' rather than policy. This is consistent with what's happening in the US now. This leaves FDA out of the loop....That assumes the public is willing to assume greater risk...but I don't think they understand this."

   "Interesting that, if policy changes are not made (e.g. to facilitate the process), the technologies will not matter a lot, because they won't get to market effectively anyway."
5. This team enthusiastically pursued a collaboration for expedited virtual testing, with universities/Labs acting as non-vested (i.e. independent third party) evaluators in partnership with FDA to create a mechanism for testing products throughout development---from concept stage, through prototype to final product.

By game's end the FDA team accomplished the 4 objectives agreed on at the beginning, and agreed that their key accomplishments were: passage of P6, 8, 9, 12 ; development of consortium to streamline regulatory process, and substantial improvements in FDA's information processing/dissemination capabilities (e.g. used user fee revenue for educational outreach effort to suppliers in 21 districts, accomplished hardware and software upgrade for all of FDA).

The team identified the following key learnings from the game:

1. Universities, Labs and others were very receptive to consortium arrangements ("Synergy is what makes movement...bringing the groups together.")

2. To meet your objectives in this game, it is very important to "do your homework" (up-front planning such as setting groundrules for decision-making).
3. Team empowerment is critical to progress in the game (they noted that their empowered decision-making process allowed them to move much faster than some of the other teams they tried to negotiate with.)
4. FDA efforts to partner were critical to accomplishment of the objectives.

What Worked Well:
Having exact $ values printed on the money worked well. That eliminated the need for conversions (good, because the conversion factors and related explanation in the gamebook were confusing to the players on this team).

What Needs Improvement:
Roadmapping follow-on: This approach needs more thought and improvement to be effective. Assigning players to different groups in the middle of such an intense experience without allowing time to establish effective group dynamics was counterproductive. Also, changing facilitator and analyst/recorder assignments at the same time aggravated the situation.

The room was too small for this size group. Tables were too close together---noise level was too high and space too limited. Needed more wall space (or other means) for posting flipchart material.

Control team needs to standardize its decision-making process and give clear, consistent signals to the teams. The group felt it did not get consistent signals and decisions from the different members of Control (e.g. they got different answers to the same question about when dice have to be rolled with respect to approval process).

Improve process for handling money. Help teams keep money records straight by encouraging them to have the recorder hold money. Also, provide envelopes for money. Money-related material in gamebook, and some instructions given during game, were confusing. Be sure to label *all* numbers in tables in gamebook (e.g. $ or $M). Keep it as simple as possible, and clarify money-related explanations. (This team was sidetracked by money-related confusion, and diverted energy and attention away from the game to discussions aimed at clarifying questions about money).

Additional Observations: Included in above sections.
1. I believe that getting to roadmapping during a Prosperity Game is a laudable goal. However, it really did not work very well in this game. I believe this was for two main reasons:
   - We neglected the group dynamics issues of changing teams, facilitator and analyst assignments between Game & Roadmapping sessions. Failure to account for this led to a large, negative impact on group productivity/effectiveness.
   - Using technology experts as facilitators in Roadmapping is not appropriate. My technology expert facilitator tended to bias the proceedings by asking leading questions, filtering the conversation according to his technology biases, etc. Also, technology experts may not be qualified facilitators. I suggest using less biased, experienced facilitators and "seeding" each group with a technology expert, who can concentrate on the discussion as opposed to being distracted by the need to facilitate.
2. This game encouraged players to think of Labs and universities as part of the same community (i.e. no differentiation between them). This was set up at the beginning and was noticeably supported by the

content of the Fri. AM debriefings. Is this desirable for us as a Lab (in terms of building consensus on role of Labs and differentiating that role from the role of universities)? I think not.

FINAL PRESENTATION:
FDA: Presenter; Eloise Eller

Goals

- **Public Health Protection**
- **Ensure Safety & Effectiveness of Medical Devices**

Strategies

- **Improve benefit-risk ratio**
- **Speed up regulatory process**
- **Collaboration with universities/labs, providers, suppliers and insurers**
- **Information dissemination**

Accomplishments

- **Internet used to collect adverse effect data; used to get public and doctors to accept higher risk with developing technologies in light of the possible increased benefit. (P12)**
- **Regulatory approval process time decreased by 75% (P6: expedited proto-typing, P8: consultant accreditation and P9: 75% decrease in approval process)**

Accomplishments

- **Collaboration with universities/labs, suppliers, providers and insurers via consortium for rapid proto-typing**
- **Educational outreach, information exchange on Internet, upgrade FDA computer systems**

Observations

- **Emphasis of Toolkit options was on technology ("More interest in things than policy")**
- **Practice of medicine is exempt from FDA review (physician liability is real issue)**
- **Legislature seemed to be unaware of their constituents and operated autonomously**
- **Gave away power to those assumed to be in power**
- **Money was confusing**
- **Rules were inconsistent**

Lessons Learned

- **Important to do "homework" in session 1: i.e., goals, strategies, ground rules for decision-making, etc.**
- **Empowerment of individual team members**
- **Receptiveness by universities/labs and others to set up consortia with regulators**
- **Lots of money involved, made and exchanged**
- **Changing focus of FDA to be enabling, trusted, science-based, and collaborative**
- **The 'Game' is a microcosm of real world.**

Planning/Funding Organizations

Description of Strategic Planning (Session 1)
The group proceeded naturally and quickly to a definition of their objectives. Almost immediately, there was an evident division in the group on the subject of telemedicine, springing, I believe from the real life experiences of two of the participants in which telemedicine is being presented as a panacea for all that ails health care. The opinion of these two is that it is absorbing funding inappropriately from other activities which address more directly the health of patients. This polarization continued throughout the game, to a degree that I believe compromised the success of our group. One player expressed a concern that the roster for the game was too "homogeneous," overlooking significant subsets of stakeholders, and that there should have been more actively involved technologists (I gathered that she meant more people involved in hands-on technical research.)

Mission - Provide seed money to develop interventions that promise to decrease the cost of healthcare while maintaining or improving quality. Increase the amount of seed money available.

Team Challenges/Objectives
This team, as did the Prototype group, moved immediately to their perceived responsibilities of making more funding available for medical technology R&D and ensuring that proper priorities were assigned to proposals so that limited funding could be appropriately dispersed. Again, although to a lesser degree than in the Prototype game, these objectives were obviated by the surplus of funding in the other teams as well as in ours.

Goals/Strategies
- increase available funds
  - leverage resources to influence other funding organizations
- identify technologies which accomplish the following:
  - improve access to appropriate health services
  - improve health status
    - need to develop a metric for this
  - improve quality of services
  - reduce cost

There was a concern about the bias toward treating disease instead of reducing risk.

Significant Highlights
Perhaps the outstanding part of the game from our perspective was that it is practically impossible to disperse the amount of money flowing to us in the portions required by the technological efforts included in the game. There simply was not enough time to consider the projects. As a result, we came to the position that we had to think of a mechanism to apply the funds in larger chunks. Bill Wiesmann identified what we were doing as "micromanaging." The result was that we set up a number of "Centers of Excellence" for broader technological areas. The opinion in the group is that that was not at all realistic. In reality, there are many such groups passing out the money, there is no one group that looks at the overall picture, and Congress turns out to be the top level conscience. The group was of the opinion that Congress turns out to be more driven by political and commercial motivations than technical evaluations.

One incident related to our fulfilling our objectives occurred in the first interaction with the University/Laboratories Team, the prime channel through which our funding should have flowed to the technological efforts. A U/L representative came to our group and said something about telemedicine.

This triggered a vigorous, negative response from one of our group and the U/L representative immediately left. I believe that he reported to his group that we were not cooperative and the U/L group then began to get the Legislature to send us funding that was already directed.

Other highlights:

- Team was very much focused on the size of the population that would be served by the technology.
- Investments were made in areas the team thought were important but were not receiving funds from other sources. The team approached other teams to make sure funding would reach the 50% probability level.
- Used gaps in technology list as guidance.
- Focused on diseases that are most common and where there are known treatments.
- Focused on early detection.
- Team believed that R&D organizations should fund science projects while industry should fund infrastructure projects.
- Team started funding smaller projects but the small individual requests were taking too much time and the money was not being spent fast enough. The team caucused and decided to focus on grand ($1B each) themes.

  "It would be useful to have researchers participate in the game as Planning/Funding team members to see what dealing with big dollars is like."
- The planning/funding team became innovators because they felt there wasn't enough technical breadth in the University/Laboratory team.

Things that worked well

The money was substantially better than in the Prototype, but still there was considerable confusion in using two different kinds of money.

There were substantially more interactions among the teams than in the Prototype, and the interactions were more realistic. We did not seem to have to push people toward "value for value" agreements.

Things that need improvement

The game seemed to be directed much more at health care in general than biomedical technology. It seem as if medical technology has a second order effect on the dynamics of the game (and in the real world) while there are many first order effects in operation.

General observations

We were really surprised that nearly every group came to the same conclusion that the prime need was outcome evaluation, meaningful metrics to measure outcome (either real or potential), and means to collect, interpret, and disseminate those results.

I, personally, was impressed with the insight of Dr. Re in his dinner speech. His identification of the medical community as a cottage industry struggling with becoming more integrated and industrialized was an eye-opener for me. Also, recognizing that medical practitioners are paid by how much they do rather than by what they accomplish was an important insight.

The University/Laboratories Team, in our opinion, did not play their roles as we would have expected. Like most others, they seemed to be working the overall health care problem more than providing the technical expertise and development function.

Roadmap Exercise

We were given the following subjects: Education Technologies, Decision Support Systems, and Outreach activities. We actually only considered the first of those. (I served as analyst/recorder.)

We had a very difficult time with the Roadmap exercise. Again, the problem was probably that we were working at too grand a level. Our group was very motivated to make a difference in health care delivery and effectiveness, but we really did not propose technological means for bettering the situation. For the most part, once we could identify an action to improve the education of stakeholders in the health care arena, we could point to fairly near term technologies to make them happen. Health care developments seem to be much more constrained by social, cultural, and institutional barriers than by technological limitations. We did make some observations:

1. There is a difference between being educated and being informed. You can be educated and still lack important information.
2. There is a paradigm shift under way. Patients are becoming less and less passive in terms of their own health care. This process seems to be limited by the availability of the right kind of information.
3. Health care providers need to "let out our secrets."
4. The information needs to be available in some sort of interactive manner so that it can be tailored to the needs of the person (patient or provider) making the inquiry. Generic approaches have not proven to be effective.
5. The information has to be credible. Current "bulletin boards" allow anyone to say anything. How do we get credibility like that of the *Harvard Medical School Newsletter* and maintain it?
6. Any system of information dissemination should not assume that everyone has access to the Internet. Things like interactive telephone and television systems will probably be more universally available.

The steps in the education process are

1. Motivation
2. Developing content
3. Enabling delivery

All this will require technological tools, but they do not seem to be limited by technology.

Observations/Suggestions

- I think the game should have been 2 full days to get better results. It looked like the teams were just coming up to speed at the end of the game.
- Very few people knew what the results of each session were. I think feedback to the whole game after each session would greatly improve the results and the reality of the game.
- Some of the team observed that there were really 3 independent activities going on during the game: 1) the Toolkit; 2) the game itself; and, 3) the roadmapping activity.
- We didn't handle printed press releases from other teams well. Several releases were found stuck in other papers on the table and no one knew they had come in.
- I think it would have been appropriate to give an overview of the sponsoring organizations prior to the start of the game (especially Sandia as the host). Several of the team members asked ongoing questions to learn more about Sandia. Along these lines, an optional tour the last half day would be nice.
- I believe the real-time changing of technology areas and facilitators resulted in suboptimum alignments.
- I think legislative dollars (appropriations) should expire at the end of each session. (The team did not spend any 1988 appropriations during Session 2.) This would keep time pressure on the teams and encourage them to spend their money.
- Money was still too complicated. Having to perform conversions between denomination on bill and investment dollars was difficult when things were moving quickly. Patient dollars could be scaled so

that they represent a fraction of the population at such a ratio that the money represents realistic dollars to the individual while simultaneously representing dollars associated with the larger population.

- In my opinion, the other teams waited much too long to come to the planning/funding team. I understand this happened during the pilot, too. I think it would have been helpful to have reviewed the potential funding sources, the associated funding flow and relative magnitudes of the funding sources with all of the players ahead of time.
- The Legislative team's appropriations guidance should not be communicated only via written press releases.
- There was an unrealistic amount of government money.
- Team saw no value in minimally invasive therapies.
- Personal agendas were very apparent and were usually disruptive to the game.
- Two players were both concerned that there were technology biases built into the game and we're missing key technologies. They felt that the game was slanted toward telemedicine (ARPA) and optical imaging.
- One player is concerned that the group is too homogeneous, "Everyone looks the same. We've gone back 40 years." She believes we're missing big blocks of needs.

Personal Observations

- Team is strongly split on telemedicine.
- One player concerned that other team members have agendas that haven't been surfaced, and wanted to move to another team.
- One player appeared not to be familiar with the Players' Handbook.
- One player worked deals on his own initiative during Session 3.
- Team was very much focused on the size of the population that would be served by the technology.
- Legislature team would like planning/funding team to help write the next legislation.
- Discussed gaps in technology list
  - socioeconomic status (SES) impact on epidemiology
  - limited liability policy for biomaterials manufacturers

formed alliance with FDA for them to lobby the legislature on this (failed)

- Planning/Funding organization was not approached for any funding and did not spend any 1998 appropriations during Session 2.

Planning/funding team caucused to discuss where our money should be spent In my opinion, the other teams waited much too long to come to the planning/funding team

I understand this happened during the pilot, too.

I think it would have been helpful to have reviewed the potential funding sources, the associated funding flow and relative magnitudes of the funding sources with all of the players ahead of time.

- One player observed that it is difficult to identify problems/issues when the outcome of the game is not known.

FINAL PRESENTATION:

FundingOrgs: Presenter;JanieFouke

Goals/Strategies

- **Increase available funds**

- **Identify technologies which accomplish the following:**
  improve access to appropriate health services
  improve health status
  improve quality of services
  reduce costs

- **Focused on the size of the population that would be served by the technology**
- **Investments were made in areas the team thought were important but were not receiving funds from other sources**
- **Focused on diseases that are most common and where there are known treatments**
- **Focused on early detection**
- **Believed that R&D organization should fund science projects, industry should fund infrastructure projects**
- **Started funding smaller projects, but ended up focusing on grand themes**

General Observations and Summary

- **Concerns that there were technology biases built into the game and were missing key technologies**
- **Concern about the bias toward treating disease instead of reducing risk**
- **Concern that the group is too homogeneous**
- **Unrealistic amount of government money**
- **No matching needed with industry/agencies**
- **Lack of technology base in other segments**
- **Big problems were more a lack of information than a lack of technology**
- **No feedback on outcomes from first day prior to starting roadmapping activities**
- **More emphasis on health care than on technologies (generally)**

Universities/Laboratories

PARTICIPANTS:

Dr. Robert Felton	University of California at Los Angeles	
Ms. Joselyne Gallegos	Sandia National Laboratories	
Dr. Sam Varnado	Sandia National Laboratories	
Dr. Robert (Jack) Hansen	Penn State University	
Dr. Elizabeth Mort	Massachusetts General Hospital	
Dr. David Warner	Loma Linda University	
Dr. Sandra Zink	Los Alamos National Laboratories	
Dr. Olin Bray	Sandia National Laboratories	Facilitator
Dr. Keith Miller	Sandia National Laboratories	Analyst/Recorder

General Comments:

The prosperity game part of the sessions went fairly well, but the roadmapping left a lot to be desired. Many people commented on the apparent disconnect between the prosperity game and the roadmapping. If you already knew a lot about the health care system, the prosperity game added little, but if you did not know much you could not contribute much to the subsequent roadmapping sessions. Several of the people in my roadmapping group (preventive medicine, environmental health, incentive programs, and others for both policy and technology) expressed a willingness to work on follow up sessions, but NOT on those topics.

Our group did some work after dinner Wednesday (about an hour), mainly to identify questions that needed to be addressed the next morning not to actually resolve them. This homework addressed questions such as roles for team members, selection criteria, and strategy.

The next morning we decided to operate as a homogeneous team, not to assign specific lab roles to people. You can tell from the agenda we defined a well structured set of questions, but did not have enough time to address them all. Most of the initial discussion focused on technologies (core competences), applications, and strategies for an R&D program. We had to shift to the Toolkit options before we had done the amount of analysis the team wanted to do. Our priorities did guide our selection and funding of Toolkit options, which were done in those two steps (select based on priorities and fund based on likely success). Our funding decisions were fairly reactive -- if other teams were not funding an option, then we did not fund it regardless of how much we liked it (to avoid throwing our limited dollars away). Also we rarely funded anything that was already at the 50 percent level. Ideally, what we wanted to do after the Toolkit options were selected, was go back to our "ideal" program and develop it and then get support from other teams. There was not enough time so we started meeting with other teams (later than they wanted but before we wanted to) to make deals. Once the deal making started it went fairly well (i.e. realistically) -- we can do anything. There was little selection relative to our priorities. We initiated things related to our priorities, but the priorities had little effect on whether or not we accepted a project proposed by another team. We accepted almost everything.

Agenda (8:00 am Thursday)

Introductions and backgrounds (of team members).
Core competencies for University/Lab team.
Teaming discussions. (who to team with and on what)
Define market strategy and project selection criteria.
Select Toolkit options. (by 11:30)
Define national R&D program for biomed.

Agenda items added after legislative priorities announced.

- Prioritize application areas (with respect to legislative agenda).
- Map applications to Toolkit options.
- Prioritize Toolkit options.
- Assign dollars to Toolkit options.
- Negotiate with other teams on Toolkit options.
- Redo legislative list and lobby legislature.

Core Competencies

Materials
Outcomes research
Health Services Research
Modeling
Information Sciences

- Sensors
- Communications
- Computational
  - Signal and image processing
- Systems integration (DIKA: Data - Information - Knowledge - Action)
- Information Surety

Marketing / Technology Transfer
Nanomachining

Need matrix of Applications vs Technologies

Selection Criteria

- B - bang for the buck with quality of life
- S - will it sell
- C - do we have competencies

Applications (ordered by high, medium, low - 3 is high)

- (three digits ranking for BSC)
- Minimally invasive therapy (3,3,3)
- Early diagnosis (3,3,3)
- Home health care (3,3,3)
- Quality of life for elderly and disabled (3,3,3)
- Improved administrative processes (3,2,3)
- Demand management (thru education and communications) (3,2,2)
- Trauma treatment (for military and emergencies) (1,3,3)
- Health data exchange, analysis, and use (not ranked)

National R&D Program

Selection Criteria for projects

Biggest bang for the buck, with quality of life
What will sell to funders
Match core competencies

Using the postings of what other teams were funding, we decided on funding using two general rules: (1) if no one else was funding it, we were throwing our (very limited) money away; and (2) in most cases if it

already had funding at the 50 percent level we did not add funding (only $8 went to those cases and $7 of that went to options at are only one dollar above the 50 percent level).

New Agenda (after Toolkit successes announced)
What things (2-5) do we really want?
Define them
    Who to team with on each?
        who has money?
        who has interests?
    Investment/R&D agreements
    Double legislative R&D allocation (leg)
    Information infrastructure (leg)
    Home health care (suppliers)
    Screening (HMO)
    Rapid prototyping, testing, and evaluation (consumers, FDA, leg)

Minimally Invasive Therapy Program ($100M)
    energy delivery devices (lasers, ultrasound)
    nanomachining and microtools
    image guided therapy
    real time, high resolution, 3-D images
    advanced display devices
    advanced non-invasive diagnostics
    system integration into a demonstration operating room

Distributed Intelligent Medical Information for providers and patient education ($200M)
        National resource
        Distributed computing
        Dedicated workforce
        Standards
    high speed network
    network surety
    interoperability of databases and multimedia
    integrate to legacy systems
    advanced decision support systems and data visualization
    improved access for the beta sites and general population
    data mining software
    image processing on net
    data fusion with demographics
    modeling outcomes
    anticipatory modeling - predict future disease distribution
    outcomes development, automated disease tracking

Quality of life for underserved populations ($100M)
        (e.g. elderly, disabled, rural, inner city)
    assistive technology
    advanced human/computer interface (myoclectic? sensors)
    telecommuting - drive costs down, drive quality of life up
    mental gymnasium

physical therapy
patient education
incontinence

Summary from Prosperity Game (end of day Thursday)

Goals and Strategy
- increase R&D funding
- identify areas of biomed R&D
  - bang for the buck, with quality of life
  - valued by market place
- develop long term, broad national strategy
  - (Need to brainstorm with stakeholders)

Accomplishments
- shortened FDA approval time
- 25 deals (many with matching government funding)
- $100M supplemental, earmarked funding for infrastructure
  - (used for our own internal matching with other stakeholders)
- partly developed long term strategy
- virtual center for collaborative assistive technologies
- *identified areas needing R&D and strategies
- *appreciation of other perspectives
- *team building benefits
- *alliances beyond game

Learn
- difficult to take product to market
- funding agencies need education about technology
  - (lot of groups needed education)
- cost sharing stimulated interactions between university/labs and suppliers and other stakeholders
- parallel team activity learned and worked, built on trust and planning
- *key need for coordinated national R&D program
- *awareness of complexity of problem area

*added at end of Friday after roadmapping sessions

Issue list (from Friday morning) with number of votes, each team member got two votes.

- Lack of a coordinated national biomedical research program to apply technology to reduce costs and improve quality of life. (8)
- Lack of infrastructure. (4)
- Lack of access for underserved populations. (2)
- Lack of dissemination of scientific and technical information to providers and patients. (2)
- Lack of systems approach.
- Lack of knowledge of technology options.
- Lack of quality of care standards, outcomes, etc.
- Lack of analytical decision support. (too much data, too little information)
- Lack of cost data on impacts of technology.
- Difficulty in establishing multidisciplinary teams.
- Poor MD acceptance of new technology.

- Acceptance (and wide use) of unproven technologies.
  (need more evaluation/outcomes studies for effectivity)
- Need to build business case (cost reduction).
- Technology gaps.
- Overemphasis on acute care over prevention.

Problem 1: Lack of a coordinated national biomedical research program to apply technology to reduce costs and improve quality of life. (8)
Solutions:

- Create a new agency (possibly distributed or virtual) to coordinate program.
  (example SDIO model)
- Coordinated advocacy.
- Agency acknowledged repository.
  needs, participants/contributors, technologies
- Private sector investment and guidance on strategic direction.
- Congressional support.
- Relates to Policy areas: 1, 2, 3, 5, and 6.
- Strongest connections to P1 and P6.

Problem 2: Lack of infrastructure. (4)
Solutions:

- Standards.
- Interoperability.
- Information Surety, privacy security, and confidentiality.
- Include hardware, software, middleware, etcware.
- High speed networks for multimedia.
- Database/repository.
- Federal funding for networks in underserved areas.
- Lack of dissemination of scientific and technical information to providers and patients. (another problem to be solved by better information infrastructure.)
- Relates to Technology and Policy areas:
  P1, P3, P5, T4, T7, T9 (surety), and T10 (data mining)
- Strongest connection: P3

Problem 3: Lack of access for underserved populations. (2)
Solutions:

- Decision support systems.
- Telemedicine (information vs transportation trade-off)
- Improve financial access.
- Assistive technologies.
- Low cost, smartdiagnositics.
- Home health care technologies.
- Education about resources.
  (awareness of availability and usage - cultural factors)
- Related to Technology and Policy areas:
  T1, T2, T4, T5, T8, and P1
- Strongest connection: T2 and T8

Roadmapping - Preventive Medicine/Environmental Health/Incentive Programs/Other Policy

- This group was to address all of these areas for both policy and technology issues. This was very difficult to do, so most of the discussion focused on preventive medicine since everyone had some ideas about it and the MD on the team was spending a lot of his time (around 20-30 percent) in this area.
- Initial Notes: (to capture initial discussion points)
- Prevention - A lot of reporting requirements are being placed on HMOs and providers by insurance and corporations to measure their results (HEDIS?). This data is needed for marketing to show a benefit to the ultimate payer.
- Information systems to trigger prevention reminders for providers and patients. (e.g. this patient is due for a mammogram or immunization) [solution]
- Reimbursement (fee for service) vs HMO coverage for preventive care. a lot of fee for service programs and insurers do not cover prevention. [problem]
- Prevention should be part of minimum coverage package. Standard coverage package specified by federal (greater uniformity and universality of coverage) or state. [solution]
- Who pays for mandated coverage? [problem]
- Better identification of who to screen. [solution]
- Where to put dollars in prevention (more bang for the buck)? [problem]
    - extreme example - one environmental program that cost $1 billion per
    - life saved. There have to be more effective ways to spend those dollars.
- Different access to preventive care for different groups. [problem]
- Affects of patient knowledge, culture, and behavior. [problem]
    - e.g. when to seek help and levels of compliance.
- Substance abuse. [problem]
- Preventive Medicine - Vision
- Universally available (geographically and economically)
- Emphasis on health not disease.
- Includes health education.
- Cost effective, considers risk management.
- Emphasis on primary and secondary. Tertiary coverage by normal practice.

Metrics/Attributes

1. Outcomes and process measures. (Not just process measures).
    incidence
    mortality
    morbidity
    quality of life
2. Costs (total, not just unit cost)
    global, not just screening (screening and treatment)
    over time (ex. extensive mamogram screening will increase reported incidence of breast cancer and increase initial treatment cost, but overtime it should reduce treatment cost (and mortality) because of early detection and treatment)
3. Percent of population covered
    by subgroups (at risk populations)
4. Ratio of dollars spent on prevention vs treatment.

Solutions (numbers are metrics that would be affected)
Incentives for providers and patients (includes health education) (1)
Include prevention in standard coverage package. (3)
Universal access for preventive services. (3)
(could use public health depts and schools)
Computerized reminder systems. (1,3)
Computer aided instruction. (1)
Outreach programs. (3)
Better identification of who to screen for what.
Cheaper and better screening techniques. (2,4)
Effectiveness studies for screening and prevention. (2)
Many procedures not proven effective thru RCTs.
Maintain public health infrastructure. (1,3)

Policy Pluses and Minuses

Include prevention in standard coverage
- who pays?
- state level, less uniform and universal
+ more universal coverage (than no standard)
+ federal level, more uniform and universal

Universal access for preventive services
- who pays?
+ more universal than above where you must have some coverage first
+ leverage other public investments (e.g. if delivery thru schools)

Maintain public health infrastructure
Environmental Health
Problems seen as small local issues.
(need better information system to identify broad patterns)
Funding for clean up.
Water quality.
Relate environment to health care for trade-offs in dollars wher most effective.
(more bang for buck)
Need more research data for problem identification and comparisons.
What are reasonable targets>
Need better risk assessment and education (public and providers).

Additional Analyst's Notes:
Wednesday Evening 11/1/95

One player begins dinner with impassioned description of his research work in informatics. Remainder of team members have little time to get acquainted through dinner. Some people begin to rise and leave. Another player suggests that first item of business is establish the priorities for the University/Labs team—beyond that described in game manual. He suggests the highest priority should be to develop a healthy R&D funding stream.

Considerable discussion ensued about the fundamental objectives of doing R&D—specifically whether to preserve institutions of research and to keep R&D jobs or to provide better products to consumers. Some players relying heavily on their experience. Immediately began discussion of investment/disinvestment

criteria. Group talking about identifying base investments that help health care and strengthen core competencies.

One player notes the need to determine competencies of labs, vs universities, vs industrial concerns. Team agrees that the major team objective will be -Lowering Cost while Improving Health Care People indicate they should represent their real-life roles.

Thursday 11/2/95

One player wants to establish the national R&D agenda—become the drivers, not be passive and wait for other teams to lead, Hope providers and suppliers will recognize labs/universities unique contribution to lowering health care costs. Leads discussion attempting to establish team goals. Wants a research statement that will lead the nation. Begins pushing for a Quality Functional Deployment for -optimizing team objectives.

Discussion of how they view the use of informatics in health care. Both emphasize the need for information systems accessible to consumers. Organized, accurate, well controlled information available to people as a -first source -- before they seek help in the medical system. Seems like an important issue that was not being given much attention.

Two players respond with -double the research expenditures from 1.5% of the national health care expenditures to 3.0%. Provide legislation encouraging teaming with industry and providers in innovative means of using technology to reduce health care costs while improving quality.

Another expresses agreement. Notes a big need for information management in patient billing systems. Must have better systems for registering and certifying patient billings. Takes an immense amount of time tracking billings for insurance companies and patients questions. Must have simple, self-checking systems that can be used by medical staff and poorly trained administrative staff at clinics to correctly enter treatment information and billing data. Data must be easily retrievable and certified+ for accuracy before bills are presented to insurers and patients. A call for better quality in financial systems.

Team appears to have little need to interact with other teams to determine their view of the needs. Participants came with preconceived vision of what the research needs are. Two players seem to operate as a team to push their visions most persuasively—strong characters with one presenting hard technology capability for a big laboratory and the other reinforcing concepts with medical speak. May be too easy for people to focus on what they think the sponsor wants as an outcome. Four out of the eight team members in the University/Laboratory team appear to be deep into information systems.

Some of the team members forced the issue of finding broader research areas than just information technology. Agreement was reached to list application areas and the underlying motivation for looking at the application areas. Team still unwilling to go discuss the current health care system with other teams. Want to determine where to invest their meager Toolkit investment funds rather independently.

One expresses a minority opinion of the need to do some market research for the research to help technology transfer. Need to find where the deficiencies and costs are in the US health care system and focus the research on -answering the mail. For example, 30% of your health care bill is due to administration, and the percentage seems to be continuing to grow.

Applications:
Minimally invasively therapy
Trauma treatment to undeserved and hard to reach population.
    Military situations
    Civilian disaster situations

Rural populations
Inner city
More rapid advancement of home health care (SV thinks this is a major category)
Geriatrics: Independent living, monitoring
Is ADA a driver?
Really need to focus on not just independent living, but supporting an active lifestyle
quality of life.

Legislation passed:
Health care providers can: 1. Practice telemedicine (interstate licensing)
Revision of civil and criminal penalties for malpractice
Standards have been defined for health data exchange across electronic media.
Process for insurance reimbursement for telemedicine
Doubled the R&D funding based on joint projects between universities and suppliers. Team seemed to miss significance of the strings attached to R&D funding.
One player attempts to lead discussion of how the listed R&D application areas fit into the legislative announcement.

Team member suggests that maybe the driver is the hardware cost to rural and/or inner city population as much as the software.

Observation: Two players begin to withdraw from the discussions.

Legislators tool kit investment priorities are listed along with their investment amounts.
Continue to attempt to establish process for selecting tool kit priorities.
University/Labs tool kit ranking are highly influenced by the legislator's early prioritization/ announcement.

Ranking priorities of applications bogged down into analyzing legislative actions. Group finally decides first priority will be Information Systems Architectures

Laboratory/University team seems to be impatient with the facilitator.
Facilitator attempting to help group get moving.

Laboratory/University group seemed to be slow at contacting other groups. There was very little discussion of what the objectives of the other groups may be. Team is reacting to representatives from other groups.

Facilitator and recorder begin a list of tool kit options voted by other groups, list amount of credits required for 50% probability, the number of credits already applied by other groups.
Seemed to help laboratory/university group to begin to question objectives of the other groups. L/U team begins to seek information from other teams.

Group returns to tool kit priorities and distributes its credits between four options.
After the tool kit commitments were made, the team began discussing how to aggregate the research into cross-cuts to support several tool kit options. Team became anxious to know which tool kit options had been selected, and which ones needed research to come to completion.

Legislative team approaches L/U seeking evidence that Universities/Laboratories and Suppliers were forming consortia. Legislators wanted to see that their doubling the research budget, with the provision that there be private/public projects, was producing useful research. No such agreements were found at that time. A short time later, the legislature issued a press release with explicit attention given to the need

for such consortia to be formed. Facilitator explicitly points out to lab/university team leaders the importance of the press release.

Lab/University team begins attempt to make agreements with other teams. Some team members begin to make several deals. Approximately half of the team produce only one agreement throughout the afternoon. The team produced a total of 21 agreements throughout the afternoon, meaning that some of team members produces four our more agreements.

One player convinces the legislators that laboratories/universities need their own funding to facilitate agreements with other teams. Legislators give L/U team approximately $5M with the proviso that it be used to facilitate cooperative agreements with suppliers.

Consumer who had unexpectedly gathered significant funds approached L/U team with a specific request for research to address her chronic illness. Team approached suppliers and funding agencies with the consumer to generate more funds to do the research. Agreements were successful, research proposal submitted for dice roll and successful. Consumer elated.

Two players begin to observe highly successful negotiations and begin to discuss the need to coordinate the research and funding within the government (very much aligned with their belief that such coordination is needed in real life.)

Funding agencies announce opportunity to fund five centers of excellence at $1B each. One player and consumer write a proposal for a virtual center for assistive equipment development. Proposal is funded.

Observation: Laboratory/University team seemed to coalesce and operate well. Clearly had strong leaders, but other team members contributed to the objectives and to the game.

FINAL PRESENTATION:
Univ/Labs: Presenter; Sandra Zink

Goals

- **Define pathway to increase funding for biomedical research**
- **Identify technologies that can improve quality of care, quality of life, improved accessibility for under-served that reduce costs.**

Accomplishments

- **Identified strategy for building a coordinated national program for biomed R&D (Strategic Health Care Office)**
- **Achieved greater understanding of complexity of this problem (all different perspectives)**
- **Identified areas of technology needing more R&D investments**
- **Team building - future alliances**

Lessons Learned

- **Key need is a national focus and coordinated approach**
- **Raised out awareness of complexity of the issues involved**
- **Workshops can be fun!**

Lawyers

I. Strategic Planning

The Lawyer team strategy from Session I was captured in their Mission Statement: " To facilitate the games, with a focus on high-tech healthcare, and to settle disputes quickly to enable advances in, and to lower the costs of, healthcare delivery systems."

This mission statement was arrived at after strategy discussions which included comments like, "I was thinking on the flight out how we could shut this thing down if we choose to do so..." and "What are we trying to accomplish? How do we win this game?"

It was clear to the attorneys at the outset that the other teams would need sound legal advice early - during their strategy and decision-making processes, and that was the preferred role of the attorneys; but like most things in life, the value of their service would not be fully recognized until some initial legal mistakes had been made and they were then called upon to come in and bail their new clients out of a self-induced problem state. Several members of the team roamed the room to solicit retainers and essentially join the other teams as legal counsel, but were wholly unsuccessful in that goal at this point in the game. They returned to the table a bit dejected from their marketing efforts, and some were even met with accusations of "Ambulance chaser", or "You'll just get in the way of the great things we're trying to accomplish here."

II. Significant Highlights

The team reassembled and decided to compile a list of legal issues/problems/challenges while they waited for the fee-bearing legal work they suspected would develop as the other teams set strategy and began to interact, devoid of sound legal counsel. They identified their top three concerns from a legal viewpoint as:

1.) Current state jurisdictions which should be federal
    - -Privacy of records
    - -License to practice medicine
    - -Product development regulations

2.)FDA Approval Issues
    - -Applications too broad
    - -Process too slow
    - -Open up experimental procedures to voluntary participation

3.) Product Liability Issues
    - -Who is doing the work in telemedicine?
    - -Public perception of technology as infallible
    - -Malpractice boundaries

As a reminder to the other teams to plan for the costs of legal entanglements, the lawyer team published a Fee Schedule. This was not well-received by the other teams, but the lawyers felt the other teams were caught up in an unreal state of benevolence that was destined to dissipate as the games progressed.

And of course, they were right. Patent feuds began, two Antitrust cases broke the monotony when the Provider II team began to act as a single cohesive HMO-like unit, and the insurers failed to offer more than a single policy option in the marketplace. In the legal morass which quickly followed, each lawyer became more-or-less associated with a given team and helped to chart a course away from rough legal seas. At long last they were successful in their prime objective of enabling the play among the teams and helping to chart strategy for their teams. Our table was at this point vacant except for the Facilitator and the Analyst.

III. General Team Observations

Initial team instructions should incorporate legal aspects of potential actions. Toolkit investments really don't apply to the Lawyers as a team. They resolved this by brokering their credits to help their new client-teams.
Assign a Lawyer per team, instead of a team called "Lawyers".
Instruct the teams to budget for legal expenses as a cost of doing business.

ANALYST/RECORDER REPORT

November 2, 1995, a.m.
The group began the game during the breakfast "informal time." They used the time to reintroduce one another. From that point, the group began discussing the game, specifically by asking two questions: 1) how the group would handle conflicts which might emerge from game play; 2) how the core competencies of the group might best be utilized to resolve potential problems. In answering the second question, the range of experience within the group went from two years to "many years."

The first question was postponed while the group examined the description of the lawyer's role as described in the players' handbook. All group members concluded the description was vague. Because of this lack of definition, the group felt it necessary to define for themselves how they would participate in the game. Members discussed the option of "bringing the game to a grinding halt through some of the actions they could instigate." A second option was to treat lawyers as a constituent group itself rather than as advocates for any one of the groups. The group decided on the latter option.

ROLE DEFINITION
After identifying the extent of experience and the particular expertise of each member of the group, they proceeded to determine how they would work together. In order to maximize the talents available and avoid potential ethical problems, they decided to be a "firm." As a firm, members could facilitate the games and provide a legal resource to all teams. As a resource, the group decided they could act in an advisory capacity to those who approached the team and/or provide advocacy in terms of policy changes as well as potential client actions.

The group interacted among themselves for the first hour or so after the official start of the games. This was partly due to the fact that while other teams were beginning dialogues, none had approached the lawyers. The facilitator was very effective in motivating the group to take action beyond just talking. Richard and Marvin took the lead in recommending ways to better integrate the lawyers with the other teams, though there was never a time when any member was reticent about contributing to the discussion.

STRATEGIES/CHALLENGES
The group realized early that one of it's challenges was how to make effective use of the limited amount of money they were allocated. They strategized about investing with other teams for the group's priorities to become reality in the context of the game. (The group also spoke to the fact that investing in the ways they considered to make the game work might be a conflict of interest in the real world.) The challenge was how to market their services. Again, the group talked about how the firm could split it's time between representational responsibilities and the responsibilities of a bar association. As a bar association, the group could advocate for policy changes or develop new policies in the area of biomedical thrusts. Strategic planning also involved identifying and prioritizing the issues. The issues identified as important included: 1) cross-state licensing for doctors; 2) infrastructure issues/technology policy in telecommunications areas; 3) malpractice and patient liability; 4) Medicare payments for experimental procedures (group wondered whether this was a legal issue or one for the consumers/doctors; 5) intellectual property issues.

Following this discussion, the group determined it's mission statement: “To facilitate the games with a focus on high-tech health care and to settle disputes quickly thus enabling advances in the health care delivery system.”

Interactions

As a means of reaching out, specific team members approached other teams to see how they might invest with them. Francoise was concerned with policy and approached the FDA, who would not talk with her until after 10 a.m. At that dismissal, she went to the ROW team who directed her to the legislature. That group also refused to talk with her until after 10 a.m. She was very frustrated by the lack of receptiveness. Shortly after Francoise returned to the table and after 10 o'clock, a legislator approached the lawyers at the recommendation of the ROW team. She was requesting help from the lawyers to flesh out the laws in which the legislature was interested. When asked about method of pay, the legislator responded, "Congress never pays."

In the course of the several discussions held by the group, Francoise became the designated 'firm manager.' She was the only one to ask how the group should market its services and make money in order to survive. She was clear that in real life, people are paid for the services provided. The team decided it could make money by writing agreements and brokering deals. They also decided to charge a fee for lobbying efforts. Over the course of the day's activities, she kept the group on task about writing retainer agreements and setting a fee schedule. The group stated that if the other teams were really serious about re-inventing the industry, they would approach the lawyers to assure the deals were legal. "You have to cast your bread upon the water for your ship to come in."

As another marketing tool, Francoise suggested the group could publish an article and use the media to promote the message of the group. She went to the media and interviewed with them. After the news was announced, she was very upset at the way the press was reporting and distorting what she had commented upon. Real life!

The team strategy also included getting familiar with the other team's interests and goals. Each team member was assigned a specific group to approach and then bring the results back to the group so they could most effectively discuss the next segment of the game, Toolkit options.

Of particular note about this team was the collegiality. Everyone had an opinion and worked cooperatively with the other members. There was de facto leadership by two of the members but it could easily have been assumed by any one of the team, as I saw no shrinking violets, nor any prima donnas.

Tookit options

After listening to the other team's concerns, home health care, anti-trust concerns, privacy, the group continued to check the progress of some of their favored options. T33-34 were of interest in the area of energy delivery devices because of the potential effect on a large market segment and the potential for reducing the cost of treatment for the consumers. T24-25 were considered because they were seen as an inexpensive way to bring providers and insurers together which might ultimately appeal to the managed care providers. T2, 3, and 4 wee seen as important consumer privacy issues. P1, 5, and 6 were considered important policy options as they impacted the areas of research and informatics.

Ultimately the group decided to invest $10M in T7, following the lead of providers, which related to outcome based databases and envisioned to be used as a basis for medical treatment. They invested $20M in P1 as they saw it allowed for a more reasonable time for new technology to get FDA approval. These investment areas were seen as a means to reach out to other teams in a positive way in order to become more a part of the action.

Doing business

Following the heavy action in the Toolkit session, business began to boom for the lawyers. Suppliers approached and Robert took the lead with this group by discussing a retainer contract with them. It was during this time that the group got more serious about designing a simple fee structure for the firm. Early in this part of the game, Robert drew the short straw and became an ill consumer with no insurance. He left the group to assume his role.

As they watched business going on around them, the members commented that the lack of for real circumstances of the game make some of the collaborations a client's dream, not to have to deal with lawyers to make a deal. Because of that concern, the group felt strongly about continuing to educate other teams about the danger of proceeding with some of the negotiations without adequate advice on potential anti-trust violations. In fact, even if an anti-trust issue were to arise, there was no enforcement mechanism in the game. Almost coincidentally, team member turned patient, Robert, approached the group for legal representation. The two insurers had conspired to set a price and all insurers offered the same policy which left him no option/choice, hence they were in violation of the anti-trust laws.

The team took the problem to the ROW team which noted the lack of enforcement and assigned the analyst/recorder to be the justice department. She approached the insurers about the problem. This anti-trust action continued through the afternoon with the insurers feeling the justice department was unreasonable and calling in their legislator. This ploy did not work and eventually, the cause went to trial. After a trial before the Asupreme court of Marshall and other justices,@ the insurers were found to be guilty of anti-trust. Though both sides started far apart in their settlement figures, ultimately they reached a compromise wherein the insurers were order to pay $100,000. This negotiation between parties occurred as it might in real life. **Comment: One of the patient/attorney players felt the interactions were "real life."**

Late afternoon

The group was feeling the recent activities in which they were involved were more real world. Their activities included assisting in drafting legislation, writing contract agreements, negotiating patents for FDA approval, anti-trust actions and client advocacy. In all of this work, the group finally wrote a number of contracts which brought money into the firm.

At this point, the facilitator began closure for the group by having them review their mission statement and summarize the day's activities. (See attached summary)

Friday, a.m.—Lawyer's Group

The group determined its priority issues about which someone would report back to the large group. Those issues included the following with number 1 and number 2 being the primary concerns of the group: 1) federal/state issues as relates to medical records/privacy concerns and licensure. There was recognition that federal standards of some sort should be enacted in this area; 2) reimbursement issues as relates to telemedicine, for example who's doing the work and where it happens, malpractice and who has committed it, who gets paid, what services are reimbursable, cost/benefit of telemedicine, technology failure; 3) intellectual property; 4) educating the public about technology as a benefit; 5) products liability; 6) insurance coverage.

Roadmapping Activity - Preventive medicine, Environmental medicine and Incentive programs

Perhaps because of the diversity of topics, this group took longer to agree upon which areas it would cover first. It was a small group with probably three consistent players and two players in and out of the group. After trying to agree upon the nature of the task they'd been assigned, the group finally approached the ROW team for clarification as to how it should proceed. After about forty-five minutes and several small

discussions, the group identified its first concern: preventive medicine.

Preventive medicine

There is a financial disincentive to do preventive medicine because it is not a reimbursed service, except by some of the managed care resources. One member felt better identification of people who should be screened would help save money. That led to the point that money should be invested in areas where life-saving can be maximized. In that regard, there should be more research. There is also a disparity of access for preventive care in terms of geography, ethnic groups, age groups, patient knowledge/culture.

Environmental/Public health

There is a lack of supportive science to help determine the needs in this area, hence there is a need for more data for problem identification and comparisons. The group also felt over-regulation was a problem in this area. Because of the lack of governmental understanding of the real problems in the environment, laws are often passed based on knee-jerk reactions rather than a true understanding of the issues.

Post lunch

The group proceeded better after lunch. As they developed a vision statement for technology policy, the group specifically noted the following objectives: 1) universal availability of preventative health care; 2) change the emphasis in health care to maintaining health rather than treating disease; 3) provide health education and encourage individuals to assume responsibility for her/his own health.

As ways to measure the above objectives, the following mechanisms were identified: 1) though metrics/attributes; 2) total costs; 3) ratio of dollars spent on prevention to tax dollars spent. The aforementioned objectives and the measures were further outlined on the forms provided by the ROW team and given the Game Director at the end of the game.

Personal Observations

The attorney group was very collegial. There seemed to be a concerted effort to be inclusive and treat each others as equals. There was a definite pecking order. Two players were as senior partners. Another was a constant for the team, always available and very concerned about the fiscal soundness of the firm. She injected the need to develop a fee schedule, develop contracts and staff up-dates. One player's knowledge of telemedical issues and his activities as a patient in initiating the anti-trust lawsuit added an invaluable element to the game. The two newer lawyers never shied away from the game activities. Both exhibited knowledge oftelemedicine issues and used it in their different roles. The only time one of the team members withdrew was after returning to the group after being a patient. I believe he felt out of the loop, and had a hard time engaging again. This is one of the times where the facilitator shined. She invited his participation and brought him back into the group.

All of the members participated and the group usually proceeded after reaching a consensus on direction. The biggest problem was that members frequently disappeared to make or take phone calls. This seemed to happen when each person's particular client appeared looking for her or him. This was pretty easily resolved by the way the group structured itself. If someone was not available, as partners in the law firm, someone else met with the client. Overall, I really enjoyed the collegiality, humor and input of the group. They also worked to be a positive force to the games..

FINAL PRESENTATION:

Lawyers: Presenter; Richard Marks

What did we accomplish?

1) **Success in lobbying the legislature**
2) **Success in obtaining intellectual property rights**

3) Represented clients well in all areas
4) Educated the providers who are participants in the games
5) Extricated clients from troubles of their own making and made a modest return

---

What did we learn?

1) In the morning while under pressure, clients in the medical field made deals without lawyers; later when problems occurred, the lawyers had to extricate them from the problems. Lesson: consult first, will be less expensive in the long run.
2) Things are so complicated in the real world around the insurance industry. That was apparent in the games as insurance team players and the providers were confused about what they could offer....even after a lawsuit.
3) The initial set-up of the teams should mirror the actual legal constraints more realistically; there should be more realistic team groupings which would include legal counsel for each team who is knowledgeable in that particular team's area.
a) So agreements are more realistic
b) Because various teams perceived conflicts when lawyers for both sides were at one table...it was an uncomfortable situation for them.
4) Lawyers are here to represent their clients, not necessarily to represent "the law" or "lawyers" as defined in the game book on page 21.
5) "The life of the law is not logic, but experience." Oliver Wendell Holmes
"A page of history is worth a book of logic." OWH

General Observations

1) Each team should have had at least a modest legal expense account
2) "Most medical folks won't turn on the lights without consulting their lawyer first."
3) The ethical considerations for lawyers were unreal because there are some things which occurred that lawyers would not be able to do in real life.
4) The Toolkit investments did not apply to lawyers.
5) The games helped broaden the perspective of the technical legal and ethical considerations and the types of interplay which occur.
6) No one saw lawyers as enablers.

APPENDIX J: ISSUES AND POSSIBLE SOLUTIONS

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY	
Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue): **Patients and providers need access to health care information and medical records that are accurate and can help make health care decisions about: providers, hospitals, treatments, drugs, technologies, costs and self-care.**	Team: **Consumers** Issue Number: **1** Relative Priority: **5** (1=very low to 5=very high) Priority Ranking: **1** (1=first, etc.)

Possible Solutions:

- **National health care information infrastructure**
- **Outcomes management information network**
- **Standards**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	**XX**
4 Health Informatics	**XX**	4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	**X**
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools	**X**	**7 Public Utility/Honest Broker/**	**X**
8 Telemedicine	**X**	8 **Clearinghouse**	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY	
Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue): **Improve the consumer's ability to care for themselves in the home and practice preventive medicine.**	Team: **Consumers** Issue Number: **2** Relative Priority: **5** (1=very low to 5=very high) Priority Ranking: **2** (1=first, etc.)

Possible Solutions:

- **Linkages to the provider**
- **Home monitoring and surveillance**
- **Home diagnosis and therapy**
- **Home health "Quicken"**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics	**X**	1 Legislative/Regulatory Reform	
2 Assistive Technologies	**X**	2 Incentive Programs	**X**
3 Energy Delivery Devices		3 Information Surety/Security	**X**
4 Health Informatics	**X**	4 Tort Liability Reform	
5 Microelectronics and Sensors	**X**	5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools		**7 Liability**	**X**
8 Telemedicine	**X**	8	
9 Non-invasive Diagnosis	**X**		
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Consumer**
Health care for the uninsured and underinsured.	Issue Number: **3**
	Relative Priority: (1=very low to 5=very high) Priority Ranking: **3** (1=first, etc.)

Possible Solutions:

- **Implantable birth control**
- **Immunization clinics**
- **Mobile diagnostic and therapy clinics**
- **Develop assistive technology to return individuals to the work force**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies	**X**	2 Incentive Programs	**XX**
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics		4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies		6 Funding Allocation Systems	**X**
7 Outcomes Research Tools		7	
8 Telemedicine	**XX**	8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Provider I**
Keeping the focus on quality:	Issue Number: **1**
• **Continuous quality improvement (constructive, critical, internal review)**	Relative Priority: **5** (1=very low to 5=very high) Priority Ranking: **1** (1=first, etc.)
• **Commitment to valid outcomes data (to obtain and implement)**	
• **Preserve physician prerogatives (to adopt or test new treatments or technologies within appropriate professional guidelines.**	

Possible Solutions:

- **Informatics with quality metrics**
- **Reward quality care (define, use metrics)**
- **National outcomes for outcomes/standards**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies		2 Incentive Programs	**X**
3 Energy Delivery Devices		3 Information Surety/Security	**X**
4 Health Informatics	**X**	4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	**XX**
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools	**XX**	7	
8 Telemedicine		8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Providers I**
Linking independent physicians into effective care delivery units while maintaining entrepreneurial spirit, focus on the patient and physician leadership.	Issue Number: **2**
	Relative Priority: **4** (1=very low to 5=very high)
	Priority Ranking: **2** (1=first, etc.)

Possible Solutions:

- **Legislative relief to allow physicians to aggregate assume risk**
- **Info systems which link business practices, outcomes and patient records allowing seamless movement of patients through the system (this will improve quality and reduce waste, therefore decreasing cost/unit of service)**
- **Decision support software (validated and up-to-date)**
- **Require physicians to use electronic media for billing**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**XX**
2 Assistive Technologies		2 Incentive Programs	**X**
3 Energy Delivery Devices		3 Information Surety/Security	**X**
4 Health Informatics	**XX**	4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	**X**
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools		**7 Electronic Billing Requirement**	**X**
8 Telemedicine		8	
9 Incentives for Use ofInfo System	**X**		
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Provider I**
Increase efficiency • **Maximize use of information technology** • **Adopt other waste-avoiding technologies**	Issue Number: **3**
	Relative Priority: **3** (1=very low to 5=very high)
	Priority Ranking: **3** (1=first, etc.)

Possible Solutions:

- **Secure electronics medical records**
- **Secure telemedicine**
- **Administrative management system**
- **Physician education to get them 'on-line'**
- **Structuring of virtual organizations as infrastructure**
- **Legislative clarification of who owns data and terms of use**
- **Technologies for out-patient care to replace inpatient care**
- **Obviating multiple (redundant) tests and therapies with single cost effective ones**
- **Care mapping as standards of practice**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics	**X**	1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies	**X**	2 Incentive Programs	**X**
3 Energy Delivery Devices		3 Information Surety/Security	**XX**
4 Health Informatics	**XX**	4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies	**X**	6 Funding Allocation Systems	
7 Outcomes Research Tools		7	
8 Telemedicine	**X**	8	
9 Incentives for Use ofInfo System	**X**		
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Providers II**
Outcomes based practice	Issue Number: **1**
	Relative Priority: (1=very low to 5=very high) Priority Ranking: **1** (1=first, etc.)

Possible Solutions:

- **Couple assessment of outcomes and expectations**
- **Decisions should be shared with consumer and based on good analytic information**
- **Decision support system offering consumer real time, interactive, real-data-based, user-friendly support**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics	**X**	4 Tort Liability Reform	**X**
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	**XX**
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools	**XX**	7	
8 Telemedicine	**X**	8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Providers II**
Wellness	Issue Number: **3**
	Relative Priority: (1=very low to 5=very high) Priority Ranking: **2** (1=first, etc.)

Possible Solutions:

- **Compliance monitoring**
- **Incentives (societal, organizational, individual)**
- **Communication (including driving records)**
- **Link to genetic issues**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics	**X**	1 Legislative/Regulatory Reform	
2 Assistive Technologies		2 Incentive Programs	**XX**
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics		4 Tort Liability Reform	
5 Microelectronics and Sensors	**X**	5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies	**X**	6 Funding Allocation Systems	
7 Outcomes Research Tools		7	
8 Telemedicine	**X**	8	
9 Preventive Medicine	**X**		
10 Public & Environmental Health	**X**		
11 Medical Genetics	**X**		
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY	
Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue): **Major health problems /assistive technology**	Team: **Providers II** Issue Number: **4** Relative Priority: (1=very low to 5=very high) Priority Ranking: **3** (1=first, etc.)

Possible Solutions:

- **Durable medical equipment (including first-time fitting issues)**
- **Major organ failure support**
- **Legal issues**
- **Individual organ problems**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics	**X**	1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies	**XX**	2 Incentive Programs	**X**
3 Energy Delivery Devices	**X**	3 Information Surety/Security	
4 Health Informatics		4 Tort Liability Reform	**X**
5 Microelectronics and Sensors	**X**	5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies	**X**	6 Funding Allocation Systems	**XX**
7 Outcomes Research Tools	**X**	7	
8 Telemedicine	**X**	8	
9 Preventive Medicine	**X**		
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY	
Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue): **Communication**	Team: **Providers II** Issue Number: **2** Relative Priority: (1=very low to 5=very high) Priority Ranking: **4** (1=first, etc.)

Possible Solutions:

- **Video, audio and text-links teleconferencing**
- **Information about clients**
- **Universal database**
- **Client monitoring systems (vital signs, chemistry)**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics	**X**	1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	**X**
4 Health Informatics	**X**	4 Tort Liability Reform	
5 Microelectronics and Sensors	**X**	5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies		6 Funding Allocation Systems	**X**
7 Outcomes Research Tools	**X**	7	
8 Telemedicine	**XX**	8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Providers II**
Public health and environmental health	Issue Number: **5**
	Relative Priority: (1=very low to 5=very high) Priority Ranking: **5** (1=first, etc.)

Possible Solutions:

- **Link environmental issues to medical treatment**
- **Sensors for environmental systems with real-time feedback**
- **Real item (two-way) introduction to state health system / locally relevant**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**XX**
2 Assistive Technologies		2 Incentive Programs	**X**
3 Energy Delivery Devices		3 Information Surety/Security	**X**
4 Health Informatics	**X**	4 Tort Liability Reform	
5 Microelectronics and Sensors	**X**	5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies		6 Funding Allocation Systems	**X**
7 Outcomes Research Tools	**X**	7	
8 Telemedicine	**X**	8	
9 Preventive Medicine	**X**		
10 Public & Environmental Health	**XX**		
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Insurers**
The lack of organized information in a standard format (or the analytic techniques) that systematically allows the evaluation of outcomes that can guide the management of health care.	Issue Number: **1**
	Relative Priority: **5** (1=very low to 5=very high) Priority Ranking: **1** (1=first, etc.)

Possible Solutions:

- **Standard electronic medical records**
- **Lifetime histories/records**
- **Measurement tools - knowing what data to collect and how to use or evaluate the information**
- **Standardization of communications and interoperability**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies		2 Incentive Programs	**XX**
3 Energy Delivery Devices		3 Information Surety/Security	**X**
4 Health Informatics	**X**	4 Tort Liability Reform	**X**
5 Microelectronics and Sensors	**X**	5 Metrics/Systems for Cost/Quality	**X**
6 Minimally Invasive Therapies		6 Funding Allocation Systems	**X**
7 Outcomes Research Tools	**XX**	7	
8 Telemedicine	**X**	8	
9			
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Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Insurers**
	Issue Number: **2**
Episodic acute care does not support preventive health of chronic management. Consumers will become 'change agents'. Applications and technologies aren't focused on consumers.	Relative Priority: **4** (1=very low to 5=very high)
	Priority Ranking: **2** (1=first, etc.)

Possible Solutions:

- **Personal health information systems**
- **Branding of electronic health applications to stimulate investment**
- **Leverage converging consumer interactive services for health goals and technology implementation**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies		2 Incentive Programs	**XX**
3 Energy Delivery Devices		3 Information Surety/Security	**X**
4 Health Informatics	**XX**	4 Tort Liability Reform	**X**
5 Microelectronics and Sensors	**X**	5 Metrics/Systems for Cost/Quality	**X**
6 Minimally Invasive Therapies		6 Funding Allocation Systems	**X**
7 Outcomes Research Tools		7	
8 Telemedicine	**X**	8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Legislature**
	Issue Number:
Market facilitation: Existing laws, lack of standards and the regulatory environment limit the rate of advancement of the development, implementation and assessment of biomedical technology.	Relative Priority: (1=very low to 5=very high)
	Priority Ranking: **1** (1=first, etc.)

Possible Solutions:

- **Tort reform - product liability; medical malpractice. Balancing the need for medical oversight with reducing the need for penalty for mistakes**
- **Streamline FDA regulations - reduce review time, review classification of devices, expand product evaluation (in the market) to assure quality and identify problems quickly**
- **Implement government standards - hopefully to be adopted by all. Specifically, government should define standards, data content, electronic messages, for clinical and administrative data**
- **Insure confidentiality and privacy - by enacting laws with civil and criminal penalties for inappropriate use**
- **Cross-state licensing fortelemedicine**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics	**XX**	4 Tort Liability Reform	**X**
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	**X**
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools		7	
8 Telemedicine		8	
9			
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Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Legislature** Issue Number: Relative Priority: (1=very low to 5=very high) Priority Ranking: **2** (1=first, etc.)
Assessing cost and quality: The moving target problem. Assessing cost and quality is difficult enough but 'moving targets' make it worse. Each of the following affects costs and quality in unpredictable ways: **1) New indications for a technology (e.g. the lap costs may decrease but aggregate costs increase) 2) Changes in the technology itself** **3) Alternative technologies change 4) New technologies enter the market**	**holy and PTCA experience; unit**
Possible Solutions: **Improved assessment capacity to 1) collect data (clinical trials, outcomes research), 2) analyze data, 3) formulate findings (e.g. practice guidelines), 4) disseminate findings and 5) monitor impact and generate feedback.**	

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics	X	1 Legislative/Regulatory Reform	X
2 Assistive Technologies	X	2 Incentive Programs	
3 Energy Delivery Devices	X	3 Information Surety/Security	X
4 Health Informatics	X	4 Tort Liability Reform	
5 Microelectronics and Sensors	X	5 Metrics/Systems for Cost/Quality	X
6 Minimally Invasive Therapies	X	6 Funding Allocation Systems	
7 Outcomes Research Tools	X	7 **Data collection, management**	X
8 Telemedicine	X	8 **and assessment**	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Suppliers** Issue Number: **1** Relative Priority: **4.5** (1=very low to 5=very high) Priority Ranking: **1** (1=first, etc.)
How should the benefits of technology application be measured? (viewed from: business, society, patient, providers, employer, family, insurer/payer, vendors, and regulatory viewpoints)	
Possible Solutions: **Measure benefits of technology** • **Collect data from all aspects/viewpoints** • **Identify the general areas of data to collect from all viewpoints** • **Develop models and tools to analyze data and help decision makers in considering all aspects**	

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	X
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	X
4 Health Informatics	X	4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	XX
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools	X	7	
8 Telemedicine		8	
9 **Decision Support Systems**	XX		
10 **Educational Tools**	X		
Provide additional details about new area(s): **9. Tools to allow decision makers to effectively view the impacts of decision on all parties/aspects.** **10. Information tools to improve education (preventive health care is the goal).**		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY	
Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue): **Regulatory and economic environments are not conducive to bringing innovations to market.**	Team: **Suppliers** Issue Number: **2** Relative Priority: **4.25** (1=very low to 5=very high) Priority Ranking: **2** (1=first, etc.)

Possible Solutions:

- **Reduce the time in FDA procedures by using clear steps and clear policy**
- **Develop ways to improve teaming between industry and FDA (reduce the adversarial relationship)**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**XX**
2 Assistive Technologies		2 Incentive Programs	**X**
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics		4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools		7	
8 Telemedicine		8	
9			
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Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY	
Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue): **Expectations: What are the expectations of FDA (acceptable norms, productivity)?**	Team: **FDA** Issue Number: **1** Relative Priority: (1=very low to 5=very high) Priority Ranking: **1** (1=first, etc.)

Possible Solutions:

- **Legislative/regulatory reform**
- **Educational outreach (information dissemination)**
- **Funding at appropriate level for 'new' expectation**
- **Review all functions and systems and restructure if necessary**
- **FDA information management**
- **Risk/benefit analysis**
- **Consider public expectation**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	**X**
4 Health Informatics		4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	**X**
6 Minimally Invasive Therapies		6 Funding Allocation Systems	**X**
7 Outcomes Research Tools		7 **Industry & Public Outreach**	**X**
8 Telemedicine		8 **Risk/Benefit Assessment and**	**X**
9		**Acceptance**	
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY	
Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue): **Unclear standards and expectations for acceptable norms for the approval process. How long should approval take? How much risk is assumed by the agency or accepted by the individual?**	Team: **FDA** Issue Number: **2** Relative Priority: (1=very low to 5=very high) Priority Ranking: **2** (1=first, etc.)
Possible Solutions: • **Legislative reform** • **Clearer communication** • **Establishment of standards** • **Establish accreditation consultants to help people through the maze**	

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics		4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools		7 **Accreditation Consultants**	**X**
8 Telemedicine		8 **Educational Outreach**	**X**
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY	
Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue): **IMAGE**	Team: **FDA** Issue Number: **3** Relative Priority: (1=very low to 5=very high) Priority Ranking: **3** (1=first, etc.)
Possible Solutions: • **Educate public on positive work of FDA** • **Emphasize partners in compliance to benefit the public health and safety** • **Champion information management systems to move technology and product development**	

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies		2 Incentive Programs	**X**
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics		4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	**X**
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools		7 **Information Management**	**XX**
8 Telemedicine		8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Planning/Funding**
	Issue Number: **1**
There is a disconnect between intelligent allocation of resources by funding agencies and the effectiveness of those allocations due to a lack of adequate metrics to assess the impact of technologies on : decreased morbidity/mortality; improved quality of life; and, cost impact on health care delivery.	Relative Priority: **5** (1=very low to 5=very high) Priority Ranking: **1** (1=first, etc.)

Possible Solutions:

- **Establishment of assessment standards**
- **Earlier introduction of metrics**
- **Defining yardstick by which we assess efficacy**
- **R&D funding based solely on efficacy (independent of profit motive)**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics		4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	**XX**
6 Minimally Invasive Therapies		6 Funding Allocation Systems	**X**
7 Outcomes Research Tools	**XX**	7	
8 Telemedicine		8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Universities/Labs**
	Issue Number: **1**
There is no coordinated national program to apply existing technology or develop new technology specifically directed at reducing health care costs and improving quality of life.	Relative Priority: **5** (1=very low to 5=very high) Priority Ranking: **1** (1=first, etc.)

Possible Solutions:

- **Create an agency (could be distributed) to coordinate federal efforts to apply technology to cost reduction and quality improvement (e.g. SHCO)**
- **Create, energize and coordinate advocacy groups (distributed basis)**
- **Create a repository of data needs, participants, technology information and procedures that is acknowledged and used by the new agency**
- **Insist upon private sector investment and strategic direction**
- **Educate, motivate and coordinate Congressional support**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**XX**
2 Assistive Technologies		2 Incentive Programs	**X**
3 Energy Delivery Devices		3 Information Surety/Security	**X**
4 Health Informatics		4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	**X**
6 Minimally Invasive Therapies		6 Funding Allocation Systems	**XX**
7 Outcomes Research Tools		7	
8 Telemedicine		8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Universities/Labs**
Lack of information infrastructure.	Issue Number: **2**
	Relative Priority: **5** (1=very low to 5=very high)
	Priority Ranking: **2** (1=first, etc.)

Possible Solutions:

- **Create standards and formats for interoperability**
- **Insure availability of techniques to assure privacy, security and confidentiality (including hardware, software, and mid-ware)**
- **Continue development of high speed network technology to enable multimedia communications and connectivity**
- **Create a database/repository of medical information**
- **Provide Federal funding for hardware and software at installations at user sites**
- **Improve information dissemination to providers and patients**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	**XX**
4 Health Informatics	**X**	4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	**X**
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools	**X**	7	
8 Telemedicine	**X**	8	
9 **Information Surety/Security**	**XX**		
10 **Data Mining (intelligent database**	**X**		
access)			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Universities/Labs**
Lack of accessability to health care technologies by the underserved (rural, poor, inner cities).	Issue Number: **3**
	Relative Priority: **5** (1=very low to 5=very high)
	Priority Ranking: **3** (1=first, etc.)

Possible Solutions:

- **Decision support systems for patients**
- **Telemedicine**
- **Provide improved access to financial resources**
- **Assistive technology for improved independent living**
- **Low cost smart diagnosis**
- **Home health care**
- **Educate users/consumers about resources and usage (dealing with cultural barriers)**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics	**X**	1 Legislative/Regulatory Reform	**XX**
2 Assistive Technologies	**XX**	2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics	**X**	4 Tort Liability Reform	
5 Microelectronics and Sensors	**X**	5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies		6 Funding Allocation Systems	**X**
7 Outcomes Research Tools		7	
8 Telemedicine	**X**	8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Universities/Labs**
• **Lack of systematic approach to health care issues.** • **Lack of knowledge of technology options on the part of decision makers, funders, legislators.** • **Lack of quality of common standards. Lack of analytical decision support (too much data, too little information).**	Issue Number: **other** Relative Priority: (1=very low to 5=very high) Priority Ranking: **NONE** (1=first, etc.)

Possible Solutions:
Low priority issues, these were not discussed further.

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics		4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools		7	
8 Telemedicine		8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Lawyers**
Practicing telemedicine across state lines and the resulting need for multi-state licensure for physicians.	Issue Number: **5** Relative Priority: (1=very low to 5=very high) Priority Ranking: **1** (1=first, etc.)

Possible Solutions:
- **Uniform statelicensure act (e.g. Federation of state medical boards model Act)**
- **Federal pre-emption (National Licensing Act)**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics		4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools		7	
8 Telemedicine	**X**	8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Lawyers**
There are over 50 jurisdictions regulating the way medicine is practiced and the way medical records are treated. In order to enable interstate practice of medicine with usage of medical records there needs to be one Federal resolution which pre-empts the states in these areas.	Issue Number: **4** Relative Priority: (1=very low to 5=very high) Priority Ranking: **1** (1=first, etc.)

Possible Solutions:

- **Federal legislation**
- **Uniform state medical licensure Acts**
- **Uniform medical records Act**

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics	**X**	4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools		7	
8 Telemedicine	**X**	8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY

Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue):	Team: **Lawyers**
Reimbursement for telemedicine - insurers, like Medicare, are reluctant to reimburse for an increase in the number of consultations. Without reimbursement, practitioners will be reluctant to do telemedicine consults.	Issue Number: **1** Relative Priority: (1=very low to 5=very high) Priority Ranking: **2** (1=first, etc.)

Possible Solutions:

Managed care may solve problem. If telemedicine proves cost effective with respect to total patient care, managed care plans will pay. Medicare and Medicaid fee for service plans will have to be convinced of cost savings.

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**XX**
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics	**X**	4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies		6 Funding Allocation Systems	**XX**
7 Outcomes Research Tools		7	
8 Telemedicine	**XX**	8	
9			
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Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY	
Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue): **FDA approval: Jurisdiction is dependent upon definition.** **Definition: What is a device and what is the approval process. Process speed is an issue.**	Team: **Lawyers** Issue Number: **2** Relative Priority: (1=very low to 5=very high) Priority Ranking: **3** (1=first, etc.)
Possible Solutions: **Legislation and collaboration between FDA and industry.**	

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics		1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies		2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	**X**
4 Health Informatics		4 Tort Liability Reform	
5 Microelectronics and Sensors		5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies		6 Funding Allocation Systems	
7 Outcomes Research Tools		7	
8 Telemedicine		8	
9 **All of the above**	**X**		
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY	
Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue): **Education: Require those practicingelemedicine or using the technology to have additional certification.** **Increase general awareness of shortcomings of technology and existence of possible failures. Awareness of technology licensing (as opposed to 'stealing').**	Team: **Lawyers** Issue Number: **3** Relative Priority: (1=very low to 5=very high) Priority Ranking: **4** (1=first, etc.)
Possible Solutions: **Certification requirement: The certification requirements would require the users (physicians, nurses, etc.) to have demonstrated experience in using the new technologies.**	

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics	**X**	1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies	**X**	2 Incentive Programs	
3 Energy Delivery Devices		3 Information Surety/Security	
4 Health Informatics	**X**	4 Tort Liability Reform	**X**
5 Microelectronics and Sensors	**X**	5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies	**X**	6 Funding Allocation Systems	
7 Outcomes Research Tools		7	
8 Telemedicine	**X**	8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

THE ROLE AND IMPACT OF TECHNOLOGY IN HEALTH CARE COSTS AND QUALITY	
Problem or Issue (specific to your team, many teams or the nation; Include needs/attributes related to the issue): **Product liability in telemedicine: To what extent will the use of telecommunications to provide medical diagnosis and treatment impose disproportionate liability on manufacturers and distributors of technology?**	Team: **Lawyers** Issue Number: **5** Relative Priority: (1=very low to 5=very high) Priority Ranking: **5** (1=first, etc.)
Possible Solutions: **Legislation to limit or cap liability exposure for use of these technologies. The cap will probably apply only to punitive damages.**	

MAPPING INTO SOLUTION AREAS (Check all that apply)

Technology Areas:		Technology-Specific Policy Areas:	
1 Advanced Diagnostics	**X**	1 Legislative/Regulatory Reform	**X**
2 Assistive Technologies	**X**	2 Incentive Programs	**X**
3 Energy Delivery Devices	**X**	3 Information Surety/Security	**X**
4 Health Informatics	**X**	4 Tort Liability Reform	**X**
5 Microelectronics and Sensors	**X**	5 Metrics/Systems for Cost/Quality	
6 Minimally Invasive Therapies	**X**	6 Funding Allocation Systems	
7 Outcomes Research Tools		7	
8 Telemedicine	**X**	8	
9			
10			
Provide additional details about new area(s):		Provide additional details about new area(s):	

APPENDIX K: TECHNOLOGY/POLICY MATRIX MAPS

TECHNOLOGY / POLICY MATRIX MAP

Team:	*Consumers*			*Providers 1*		
Issue Rank:	*1*	*2*	*3*	*1*	*2*	*3*
Legend **Issues →** **✷✷ = Main areas** **✷ = Other related areas**	*Patients and providers need access to health care information and medical records that are accurate and can help make HC decisions about: providers, hospitals, treatments, drugs, techs, costs, self-care.*	*Improve the consumers' ability to care for themselves in the home and practice preventive medicine.*	*Health care for the uninsured and underinsured.*	*Keeping the focus on quality: 1) continuous quality improvement, 2) commitment to valid outcome data, 3) preserve physician prerogatives.*	*Linking independent physicians into effective care delivery units while maintaining entrepreneurial spirit, focus on the patient, and physician leadership.*	*Increase efficiency (maximize use of information technology, adopt other waste avoiding technologies).*
Broad Areas for Roadmapping:						
1 Assistive Technologies		✷	✷			✷
2 Health Informatics	✷✷	✷		✷	✷✷	✷✷
3 Information Surety and Security	✷✷	✷		✷	✷	✷✷
4 Microelectronics and Sensors		✷				
5 Minimally Invasive Therapies						✷
6 Outcomes Research Tools	✷			✷✷		
7 Preventive Medicine		✷	✷✷	✷	✷	✷
8 Telemedicine	✷	✷	✷✷			✷
9						
10						
Other Policy Areas:						
1 Legislative/Regulatory Reform/Improve			✷	✷	✷✷	✷
2 Tort Liability Reform		✷				
3 Metrics and Systems for Cost / Quality	✷			✷✷	✷	
4 Funding Allocation Systems			✷			
5						
6						
7						
8						

TECHNOLOGY / POLICY MATRIX MAP						
Team:	*Providers 2*					*Funders*
Issue Rank:	*1*	*2*	*3*	*4*	*5*	*1*
Legend **✷✷ = Main areas** **✷ = Other related areas** **Issues ➔**	*Outcomes based practice*	*Wellness*	*Major health problems - assistive technology*	*Communication*	*Public health - environmental health*	*Disconnect between intelligent allocation of resources by funding agencies and the effectiveness of those allocations due to a lack of adequate metrics to assess the impact of techs on: decreased morbidity/ mortality,*
Broad Areas for Roadmapping:						
1 Assistive Technologies			✷✷			
2 Health Informatics	✷			✷	✷	
3 Information Surety and Security				✷	✷	
4 Microelectronics and Sensors		✷	✷	✷	✷	
5 Minimally Invasive Therapies		✷	✷			
6 Outcomes Research Tools	✷✷		✷	✷	✷	✷✷
7 Preventive Medicine		✷✷	✷	✷	✷✷	
8 Telemedicine	✷	✷	✷	✷✷	✷	
9						
10						
Other Policy Areas:						
1 Legislative/Regulatory Reform/Improve			✷	✷	✷✷	✷
2 Tort Liability Reform	✷		✷			
3 Metrics and Systems for Cost / Quality	✷✷					✷✷
4 Funding Allocation Systems			✷✷	✷	✷	✷
5						
6						
7						
8						

TECHNOLOGY / POLICY MATRIX MAP							
Team:	*Insurers*		*Legislators*		*Suppliers*		
Issue Rank:	*1*	*2*	*1*	*2*	*1*	*2*	
Legend ✷✷ = Main areas ✷ = Other related areas **Issues ➔**	*The lack of organized information in a standard format (or the analytic techniques) that systematically allows the evaluation of outcomes that can guide the management of patient care.*	*Episodic acute care doesn't support preventive health of chronic management; consumers will become change agents; applications/techs not consumer focused.*	*Existing laws, lack of standards and the regulatory environment limit the rate of advancement of the development, implementation and assessment of biomedical technology.*	*Assessing costs and quality: the moving target problem. The following affect costs and quality in unpredictable ways:new indications for a technology, changes in the technology itself.*	*How should the benefits of technology be measured? viewed from: business, society, patient, providers, employer, family, insurer/payer, vendors, regulators.*	*Regulatory and economic environments not conducive to bringing innovations to market.*	
Broad Areas for Roadmapping:							
1 Assistive Technologies				✷			
2 Health Informatics	✷	✷✷	✷✷	✷	✷✷		
3 Information Surety and Security	✷	✷		✷	✷		
4 Microelectronics and Sensors	✷	✷		✷			
5 Minimally Invasive Therapies				✷			
6 Outcomes Research Tools	✷✷			✷	✷		
7 Preventive Medicine	✷✷	✷✷		✷		✷	
8 Telemedicine	✷	✷		✷			
9							
10							
Other Policy Areas:							
1 Legislative/Regulatory Reform/Improve	✷	✷	✷	✷	✷	✷✷	
2 Tort Liability Reform	✷	✷	✷				
3 Metrics and Systems for Cost / Quality	✷	✷	✷	✷	✷✷		
4 Funding Allocation Systems	✷	✷					
5							
6							
7							
8							

TECHNOLOGY / POLICY MATRIX MAP						
Team:	*FDA, Regulators*			*Universities, Labs*		
Issue Rank:	*1*	*2*	*3*	*1*	*2*	*3*
Legend **✷✷ = Main areas** **✷ = Other related areas** **Issues ➔**	*Expectations: what is expected of FDA, acceptable norms, productivity.*	*Unclear standards and expectations for acceptable norms for the approval process. How long should approval take? How much risk is assumed by the agency or accepted by the individual?*	*IMAGE*	*There is no coordinated national program to apply existing technology or develop new technology specifically directed at reducing health care costs and improving the quality of life.*	*Lack of information infrastructure.*	*Lack of accessability to health care technologies by the underserved (rural, poor, inner cities).*
Broad Areas for Roadmapping:						
1 Assistive Technologies						✷✷
2 Health Informatics					✷	✷
3 Information Surety and Security	✷			✷	✷✷	
4 Microelectronics and Sensors						✷
5 Minimally Invasive Therapies						
6 Outcomes Research Tools					✷	
7 Preventive Medicine	✷	✷	✷	✷		✷
8 Telemedicine					✷	✷
9						
10						
Other Policy Areas:						
1 Legislative/Regulatory Reform/Improve	✷	✷	✷	✷✷		✷✷
2 Tort Liability Reform		✷				
3 Metrics and Systems for Cost / Quality	✷	✷	✷✷	✷	✷	
4 Funding Allocation Systems	✷			✷✷		✷
5						
6						
7						
8						

TECHNOLOGY / POLICY MATRIX MAP

Team:	*Lawyers*					
Issue Rank:	*1*	*1*	*2*	*3*	*4*	*5*
Legend **Issues ➔** **✷✷ = Main areas** **✷ = Other related areas**	*Practicing telemedicine across state lines and the resulting need for multi-state licensure for physicians.*	*Over 50 jurisdictions regulating the way medicine is practiced and the way med records are treated. To enable interstate practice of medicine with usage of med records there needs to be some fed resolution*	*Reimbursement for telemedicine - insurers, like Medicare, are reluctant to reimburse for an increase in the number of consultations. Without reimbursement, practitioners will be reluctant to do telemedicine*	*FDA approval: jurisdiction dependent upon definition, variance in definitions, process speed.*	*Education: require those practicing telemedicine or using new technology to have an additional certification; increase general awareness of shortcomings of technology, existence of possible*	*Product liability in telemedicine: to what extent will the use of telecom to provide medical diagnosis and treatment impose disproportionate liability on manufacturers and distributors of technology?*
Broad Areas for Roadmapping:						
1 Assistive Technologies				✷	✷	✷
2 Health Informatics		✷	✷	✷	✷	✷
3 Information Surety and Security				✷		✷
4 Microelectronics and Sensors				✷	✷	✷
5 Minimally Invasive Therapies				✷	✷	✷
6 Outcomes Research Tools				✷		
7 Preventive Medicine				✷	✷	✷
8 Telemedicine	✷	✷	✷✷	✷	✷	✷
9						
10						
Other Policy Areas:						
1 Legislative/Regulatory Reform/Improve	✷	✷	✷✷	✷	✷	✷
2 Tort Liability Reform					✷	✷
3 Metrics and Systems for Cost / Quality						
4 Funding Allocation Systems			✷✷✷			
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APPENDIX L - ROADMAP OUTLINES

GENERAL TECHNOLOGY AREA: ASSISTIVE TECHNOLOGIES			
Vision of the future for the technology area: Develop technology that restores function and/or extends a capability with the outcome of improving independence, integration, development (growth), and forestalling secondary effects.			**Champions:**
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Reconnaissance (intelligence) Coalition building	Filling gaps Standards and protocols developed for modularity	Mass production / individual application
Drivers:	Gaps: Availability vs consumer knowledge Technology that has yet to be adapted Unmarked technology Lack of accountability for appropriate use of gov't funding	Reduce regulation RESNA to establish and impose standards	Reliance on manufacturers standards
Sub-technologies:	New economic model for bringing assistive technologies out from under the medical model	A clearinghouse association proving technology for safety and marketability	
SponsoringOrgs:	RESNA, NIDRR tech centers		
Attributes:	Develop faster feedback mechanisms Advancement of technology is secondary to building a new paradigm of prevention with accountabilities		

GENERAL TECHNOLOGY AREA: HEALTH INFORMATICS			
Vision of the future for the technology area: An architecture that includes an object oriented repository populated with tools that drive interoperability and connectivity including legacy systems and technologies.			**Champions:**
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Develop tools to look at baseline issues	Expand to look at security and surety issues	Expand to support Sim NII
Drivers:	Need an underlying modeling base to support modeling and system interaction problems Support modular approach to assure technology infusion Network-based economy		
Sub-technologies:	Objects (tools, applications) Intelligent agents Modeling and simulation of object architecture tools CORBA	Collaborative work environment Network technologies Artificial intelligence technologies	
SponsoringOrgs:	Koop Industry NIST DOE DOD (Sim)		
Attributes:	Modular Pay only for what you use Interactive, multimedia Context, domain specific		

GENERAL TECHNOLOGY AREA: HEALTH INFORMATICS			
Vision of the future for the technology area: System that gets the right information to the right place at the right time to the right person in the right format in a system that is flexible and scaleable.			**Champions:**
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Decrease cost, NHII Improve access to health care services, improve quality	Develop NHII Improve access to health care services, improve quality	Develop NHII Improve access to health care services, improve quality
Drivers:	More timely access to information Quality control Improved efficiency due to decreased margins Quality assurance Quality improvement	Patient demand for quality care Government demand for low cost and high quality Doctors demand to optimize care Drive intervision upstream (earlier in time)	
Sub-technologies:	GIS Sensors Networks Standards Databases (links; search, mining, and aggregation engines) High performance computers		
SponsoringOrgs:			
Attributes:	Information more available with more timely access Reduce costs Improvements		

GENERAL TECHNOLOGY AREA: HEALTH INFORMATICS			
Vision of the future for the technology area: National Information Infrastructure Simulation (Health-specific)			**Champions:**
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Local modeling on subset of data types	Enterprise modeling on subset of data types	National modeling and simulation including all data types
Drivers:	Dynamic changes in information technologies Cost of trial and error mechanism Risk Trade-off requirements for outcomes (i.e. cost models)		
Sub-technologies:	Network modeling Data modeling Architecture modeling Node/application modeling High performance computing Risk assessment		
SponsoringOrgs:	DOD AHCPR DOE NIST ARPA NLM HICPHA		
Attributes:	High fidelity High level modeling Show valuable outcomes at all stages	High fidelity High level modeling Show valuable outcomes at all stages	High fidelity High level modeling Show valuable outcomes at all stages

GENERAL TECHNOLOGY AREA: HEALTH INFORMATICS			
Vision of the future for the technology area: Patient care data and information to flow under condition of security, confidentiality, and privacy in electronic form where it is needed for patient care, management, and research.			**Champions:**
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Develop information about society's concerns and the technologies that address them	Pilot test alternative technologies for S, C & P in health information systems	Develop and test technologies for global exchange of health data under globally acceptable condition for S, C & P
Drivers:	Patient concerns Vendors concerns Public good concerns Business confidentiality concern Integrity/authenticity of data		
Sub-technologies:	Encryption technologies Public-private key Single key Single line communication Code and key management		
SponsoringOrgs:	AHCPR DOD ACLU NSF NLM DOE AMIA NSA	AHCPR NLM AMIA ACLU	Previous plus WHO
Attributes:	A system that provides the right level of surety Data logging Localized (minimal) impact		

GENERAL TECHNOLOGY AREA: HEALTH INFORMATICS			
Vision of the future for the technology area: Patient care data and information to flow electronically using standards for definition (nomenclature, terminology, structure and coding), data file content, and electronic message transmission.			**Champions:**
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Develop and continually improve a common medical terminology	Pilot test standards in individual and groups of institutions	Exchange pcd globally using standards
Drivers:	Core data sets Electronic transmission protocols Hospitals, doctors, vendors, telecommunications industry	Core data sets Electronic transmission protocols Hospitals, doctors, vendors, telecommunications industry	
Sub-technologies:	Case tools Black boxes Existing standards		
SponsoringOrgs:	ANSI HISB AHCPR X12N NLM NSA X3,HL7 FDA ARPA ASTM HCPA DOE IEEE AMA NCPDD ACP/NEMA DOD VA	Same	Same plus WHO
Attributes:	Correspondence with UMLS (NLM) Must be larger than UMLS		

GENERAL TECHNOLOGY AREA: HEALTH INFORMATICS			
Vision of the future for the technology area: Health care information is electronically exchanges in a logical format and using a common medical terminology.			**Champions:**
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Exchange medical, logical modules among health care sites	Learning systems to support data mining Data and logical model exchange	Active agents
Drivers:	Practice variations Patient education Professional societies		
Sub-technologies:	Arden system for medical logic module Metathesaurus		
SponsoringOrgs:	Professional societies Academia VA HC deliverers or receivers		
Attributes:	Self-regulation Self-updating (needs review)		Active agents

GENERAL TECHNOLOGY AREA: MEDICAL INFORMATION SURETY			
Vision of the future for the technology area: Medical information should be accessible over public networks from multiple vendor platforms with appropriate protection for privacy and integrity. Strong access control should be balanced by audit trails.			**Champions:** Judy Moore
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Refine the model of medical information systems	Extend the architecture to larger scale (e.g. Kaiser)	Address national and international issues
Drivers:		Access control and ownership of data Audit trails	Sharing and interpolating data while still protecting privacy and integrity
Sub-technologies:	SQL databases on servers Inexpensive client machines Digital signatures Open standards	Advanced key management (e.g. Kerberos) Audit trails Key management tokens (smart cards)	Public key hierarchy for key management unencumbered by patents and freely available
SponsoringOrgs:	Private industry VA, HCFA, SSA Health care industry Large HMO's	Same plus DOE	
Attributes:			

ISSUE AND PROPOSED SOLUTION: INFORMATION SURETY AND SECURITY	
Issue (including background): Policy - Create uniform laws and policies in standards for uniform privacy, data integrity, and authentication. Close the gap, traditionally 10 years or more, between technology and policy. Technology - Information technology is available that allows authorized use of data and prevents unauthorized use. The determination of authorized use is made by the owner of the data. Technologies will be developed to provide for data integrity, authentication and accuracy.	
Proposed solution: Policy - Gain widespread education of the issues involved in regulating and enabling new technology. Create an alliance of interested lobbyists, funding agencies, technology developers, and end-users. This alliance should be long-lived (15+ years) in order to get in front of the technology. Technology - Understand and define the real surety problem. Benchmark the best industry lessons learned. Aim research at adapting the technology to this problem set.	
Positives: Policy - Awareness of the problems is just the first step toward solving system issues. These issues cannot be solved in isolation - not local or state jurisdiction - probably federal laws with international standards. Technology - Enablestelemedicine and outcomes databases.	
Negatives: Policy - Privacy laws are a double-edged sword - many constituent opinions must be merged. Perception or need of privacy in medical records is a major concern. Technology - Technology is not infallible, and the public perception is different. Sorting out the access issues will be tough.	
Costs: Policy - Three years of funding to influence constituent groups in a proactive stance. Technology - Three years of funding to adapt the technologies.	
Actions (include responsible party): **Contacts:** Policy - NIH/NIST/AMA/ABA/AEA Technology - Industry stakeholders **Meetings:** **Hearings:** **White papers:** Policy - Education	**Research:** Policy - SNL leadership Technology - SNL leadership **Gaming:** **Modeling:** **Champions:** Judy Moore (SNL),Francoise Gilbert

GENERAL TECHNOLOGY AREA: MINIMALLY INVASIVE THERAPIES - ENERGY DELIVERY			
Vision of the future for the technology area:			**Champions:** Dr. David Rattner Dr. Steve Dawson
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Precise deposition Limit collateral damage	Larger volumes Overcome access problems	Completely non-invasive delivery
Drivers:	Imaging Boundary definition Effect ofTx Delivery devices Minimal access surgery Photosensitizers	Advanced delivery devices 'On-the-fly' pathology Real-time monitoring ofTx Target drug delivery - activate with energy	Bedside therapy Non-surgical access
Sub-technologies:	HIFA, microwave, RF, laser,cryo Drugs activated by energy Imaging Radionuclide PET, MRI Ultrasound contrast agents	Optical diagnostics for 'on-the-fly' pathology 'Stable-bubble' drug delivery Temporary tissueischemia	
SponsoringOrgs:	DOE Industry Universities		
Attributes:			

GENERAL TECHNOLOGY AREA: MINIMALLY INVASIVE THERAPIES - IMAGING			
Vision of the future for the technology area:			**Champions:** Dr. Steve Dawson Dr. David Rattner
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Procedure guidance	Functional imaging	Portable, real-time histologic display
Drivers:	Minimal access surgery Development of intervention procedures Point-specific anatomic display Identification of friend or foe 3D display	Image fusion Fluoro/CT CT/ultrasound CT/MR Pharmaceutical imaging	Bedside (in home) therapy Non-invasive procedure monitoring
Sub-technologies:	Tool tracking Target tracking Motion compensation Catheter-based ultrasound Flat screen displays Contrast development	PET/fast MRI Supercomputing Display Segmentation Imaging of pharmacologic effects Contrast development	Low-no radiation imaging Photon detector development
SponsoringOrgs:	Industry Labs Universities	Industry Labs Universities	NASA DOE DOD, ARPA, BMDO
Attributes:			

GENERAL TECHNOLOGY AREA: MINIMALLY INVASIVE THERAPIES - ROBOTICS			
Vision of the future for the technology area: Expand minimally invasive techniques to include medical robotic devices and procedures.			**Champions:** Dr. Fidel Davila Col. William Wiesmann
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Develop and identify current and transition technologies	Reduce costs by developing new robotics technologies	Develop use of robotic systems for home and hospital care
Drivers:	High costs High FTE (labor) Improved standardization of care Empowered nurses, MDs and paramedics	Improved outcomes in selected conditions (e.g. ventilators, dialysis)	Robotic-based home care
Sub-technologies:	Artificial intelligence Fuzzy logic controllers Efficiency and outcome targets Sensors and actuators/power must be developed	Improved sensors Improved algorithms Miniaturization	In-vivo (implantable robotic organs)
SponsoringOrgs:			
Attributes:	Robots must be as good as current technology		

GENERAL TECHNOLOGY AREA: MINIMALLY INVASIVE THERAPIES - TISSUE MANIPULATION			
Vision of the future for the technology area: Develop methods of tissue manipulation that lead to improved efficiency in tissue joining and eventual bloodless surgery.			**Champions:** Dr. David Rattner Dr. Steve Dawson
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Hemostatis Unclogging tubes	Long-term stent patency Tissue welding	Tissue replacement
Drivers:	Visualization devices	Polymers - paving Fetal wound healing Thermal devices Stent-splint Adhesives	Organogenesis Cell transplantation Biomatrix scaffold
Sub-technologies:	Mechanical Thermal/laser Polymer - glue In-line ultrasound	Advanced polymers Biomaterials	
SponsoringOrgs:			
Attributes:			

GENERAL TECHNOLOGY AREA: OUTCOMES RESEARCH			
Vision of the future for the technology area: Organize information in a variety of standards-based formats that systematically allow the ongoing evaluation of outcomes that can guide the healthcare market and health care decision makers.			**Champions:** Richard Marks Liz Mort
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Define scope Outline initial process Assess state-of-the-art Consensus build	Enact legislation QOL pilot Refine Education	National Alliance for Outcomes Research QOL functional status Continuing education for providers and consumers
Drivers:	Information systems Technology marketing Social/economic cost containment, quality enhancement, competition Health measurement tools and indices Information surety	Valid, reliable, appropriate measurement tools (e.g. for QOL and other refined elements)	
Sub-technologies:	Compression Archiving (data) Massively parallel processing Bandwidth Graphics/visual Distributed data collection		
SponsoringOrgs:	Insurers, AHCPR Howard Hughes Med. Institute HCFA, NIH,DoD, VA, HIS, NCQA, JCAHO, RW Johnson Foundation		
Attributes:	Mortality (inpatient) Major inpatient morbidity Efficiency measures (LOS, readmission rate, pre-op, post-op) Charge information Time to failure (or length of benefit) Case mix adjustment	QOL pilot Return to work Patient satisfaction Case mix adjustment refinement Begin work on ambulatory process measures of quality	QOL functional status Risk assessment (time-oriented, risk-adjusted database tied to outcome prediction/measurement) Continuing education of providers and consumers

ISSUE AND PROPOSED SOLUTION: PREVENTIVE MEDICINE	
Issue (including background):	
Vision of the future	Attributes (outcomes)
Universal availability (geographic and economic)	Outcome and process measures (mortality, QOL, etc.)
Emphasize health, not disease	Total costs, not just screening (e.g. overtime)
Include health education	Fraction of population covered by subgroups
Cost effective risk management	Ratio of prevention to treatment dollars spent
Primary, secondary, tertiary	
Proposed solution:	
Incentives for providers and patients (includes education and insurance)	
Include prevention in standard coverage	
Universal access for preventive services (public health departments and schools)	
Computerized reminders for providers	
Computerized instructions	
Outreach programs	
Cheaper, better screening techniques	
Effectiveness studies for screening, prevention	
Maintain public health infrastructure	
Positives:	
Brings closer to promoting universal coverage than if just covered by insurance	
Federal level brings uniformity to mandated coverage	
Leverages public investment	
Negatives:	
Who pays? Trying to determine who pays will cause conflict	
State level mandate means too much diversity in mandated coverage	
Costs:	
Actions (include responsible party):	
Contacts:	**Research:**
Meetings:	**Gaming:**
Hearings:	**Modeling:**
White papers:	**Champions:**

GENERAL TECHNOLOGY AREA: ADVANCED DIAGNOSTICS - NONINVASIVE SCREENING			
Vision of the future for the technology area: Develop noninvasive advanced diagnostics for CA and cardiopulmonary screening			**Champions:** Dr. Fidel Davila Col. William Wiesmann
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Identify and develop current and transition technologies	Reduce costs by identifying and developing new energy spectra	Introduce large scale screening and validation sensors for new energy spectra
Drivers:	High incidences of diagnostic and therapeutic interventions of cancer, CA, cardiopulmonary dis.	Application to renal liver and central nervous system function and disfunction	Tricorder
Sub-technologies:	Ultrasound (3D, holographic) Passive acoustic array X-ray (increase S/N) Enhanced 2D high-res γ detectors	LASER/LIDAR Near/far IR Ultrasound (3D, holographic) RF UV/light (optical diagnosis) 3D γ detector	Passive mm wave Microwave RF/interference spectroscopy Electron spin resonance spectroscopy
SponsoringOrgs:			
Attributes:	Improved S/N Decreased size and power req'd Increased efficiency and reliability Decrease false readings	Better advanced computational algorithms	same

GENERAL TECHNOLOGY AREA: ADVANCED DIAGNOSTICS - PREDICTIVE			
Vision of the future for the technology area: Develop fusion of models and sensing for predictive diagnostics (for bone regeneration, osteoporosis, wound healing)			**Champions:** Jack Hansen Janie Fouke
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Define mechanical properties of living bone in-vivo (by gender, etc.)	Marry mechanical data with theoretical model	Develop general intervention strategies based on prediction
Drivers:	Sensor development (e.g. acoustic, optical, etc.)	In-vivo prospective studies Model-sensor fusion	Advanced model development
Sub-technologies:	Wide-band signal processing	Meta-analysis Epidemiology	
SponsoringOrgs:	DoD NSF NIH	same	same
Attributes:	Enhanced diagnostic capability for osteoporosis	Initial predictive capability	New intervention strategies

GENERAL TECHNOLOGY AREA: ADVANCED DIAGNOSTICS - PREDICTIVE - HEART			
Vision of the future for the technology area: Develop fusion of models and sensing for predictive diagnostics for heart attacks			**Champions:** Jack Hansen Janie Fouke
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Improve nonlinear dynamic description of heart	Marry model and sensor for prediction	
Drivers:	Improved data analysis (e.g. frequency, other) New representations of nonlinear systems data		
Sub-technologies:	New signal processing and/or improved sensors		
SponsoringOrgs:	ONR NIH		
Attributes:	Improved methods for heart attack precursor detection	Capability to predict remaining time to heart attack	New intervention strategies for heart disease

GENERAL TECHNOLOGY AREA: EDUCATION TECHNOLOGY			
Vision of the future for the technology area: Creation of motivation or desire for information. Develop information content.			**Champions:** Jeff Richards
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Share big picture with public Identify credible information sources	Buy-in - impact resulting in individual awareness/participation Link among credible sources	Optimized mainstream health behavior Universal access
Drivers:	Recognition of shared value in health information availability	Expanded interactive access Establish interactive services	Pervasive interactive technology access
Sub-technologies:	Telephone Personal computer On-line services	Voice recognition Interactive TV/video	Customer individually integrated communications devices
SponsoringOrgs:			
Attributes:			

GENERAL TECHNOLOGY AREA: EDUCATION TECHNOLOGY			
Vision of the future for the technology area: Incorporation of information into prevention and therapy.			**Champions:**
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Prototype of expert systems and artificial intelligence/simulation	Virtual providers - AI agent based	Becomes the standard
Drivers:	Promotion of learning knowledge agents	Evaluation built into all translation	
Sub-technologies:			
SponsoringOrgs:			
Attributes:			

GENERAL TECHNOLOGY AREA: TELEMEDICINE			
Vision of the future for the technology area: Provide quality and affordable health care anytime, anyplace, utilizing accepted information and services.			**Champions:** Dr. Steve Dawson, Barbara Lindauer, John Mott, Gil Padilla, Suzy Tichenor
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Medical reference information Phone calls and fax consulting Remote audio-visual links Telepsychiatry, radiology, etc.	Expand to pathology, pervasive education and home use	Remote physical exams Telerobotic assistive exams
Drivers:	Managed care (capitated fees and managed costs) Privacy and security (including authorization and authentication) Stakeholder acceptance, inter-operability, speed, economic viability, database standards	NII availability Fidelity Interactivity	Computer literate medical students dominate community Tactility Reliability
Sub-technologies:	Encryption authorization (to be invented) Voice recognition and synthesis Social user interface Cost reduction technologies Satellite-based infrastructure on pay-for-use entertainment-generated high bandwidth to home AI-based database interpreter	High resolution, high contrast, color imagery acquisition and display Image processing to enhance items of interest and compare with standard image 3D imaging and manipulation Miniaturized motor-actuators and control system	Real-time 3D imagery Tactile sensors and actuators Nanofabrication of sensor arrays for touch Sensor-human interface Advanced simulation techniques System reliability solutions
SponsoringOrgs:	Industry, venture capitalists DOE, DoD labs State legislators	ARPA, DoD labs DOE Foundations	ARPA, DoD labs NASA, NSF, DOE Foundations
Attributes:			

GENERAL TECHNOLOGY AREA: FUNDING ALLOCATION SYSTEMS			
Vision of the future for the technology area: Research funds for health care technology will be allocated in an efficient, coordinated process with appropriate measures of effectiveness.			**Champions:** Gary Silbert
	Current (0-3 years)	**Near-term (3-6 years)**	**Far-term (6-15 years)**
Objective:	Raise awareness for this paradigm shift	Prepare program plan	Have vision in place
Drivers:	Identify members and create national technology advisors group	Establish metrics Duplication of effort Effectiveness Quality of life Outcomes research	Implement program plan Allocate resources Measure results Revise priorities as necessary
Sub-technologies:	Baseline current process Who funds What is funded Where is research $ spent What are the duplications	Develop criteria for Consolidation Allocation Compare current system to metrics	
SponsoringOrgs:	Build constituency of government agencies, congress, private sector, public sector	Develop tools Technologyroadmap Decision support tools	
Attributes:	Publish current data on WWW and newsletters Determine if incentives are necessary		

APPENDIX M: HEALTH CARE EXPENDITURES

Figure M-1 shows the predicted health care costs that were used in developing the game dollar allocation system used in the Prosperity Game. Seven years of data were extrapolated out to the year 2002. A quadratic curve fit most of the data extremely well, and was used for projecting into the future. (The quadratic rise of expenditures also highlights the extreme importance of controlling health care costs in the US.) Table M-1 shows the predicted and estimated allocations. Where data were not available, reasonable guesses were made.

TABLE M-1. ESTIMATES OF PROJECTED HEALTH CARE COSTS PER YEAR

Team	1996 per capita	1996 $billions	1998 per capita	2000 per capita	2002 per capita
Consumers: Out of pocket Private insurance payouts	$850 $1750	$212.5 $437.5	$2915	$3245	$3590
Government insurance payouts States Medicare Other Fed.	 $750 $850 $586	 $187.5 $212.5 $146.5			
Government total costs: $2250 Federal: $1500 States: $750			$2780 total	$3265 total	$3785 total
Suppliers/Manufacturers (5%)					
US FDA	$4	$1			
Research Funding Organizations: Government (DoD, NSF, etc.) Private Foundations	 $60 $5	 $15 $1.25	 $5	 $5	 $5
Total dollars available =	$4855	$1213.75	$5700	$6515	$7380

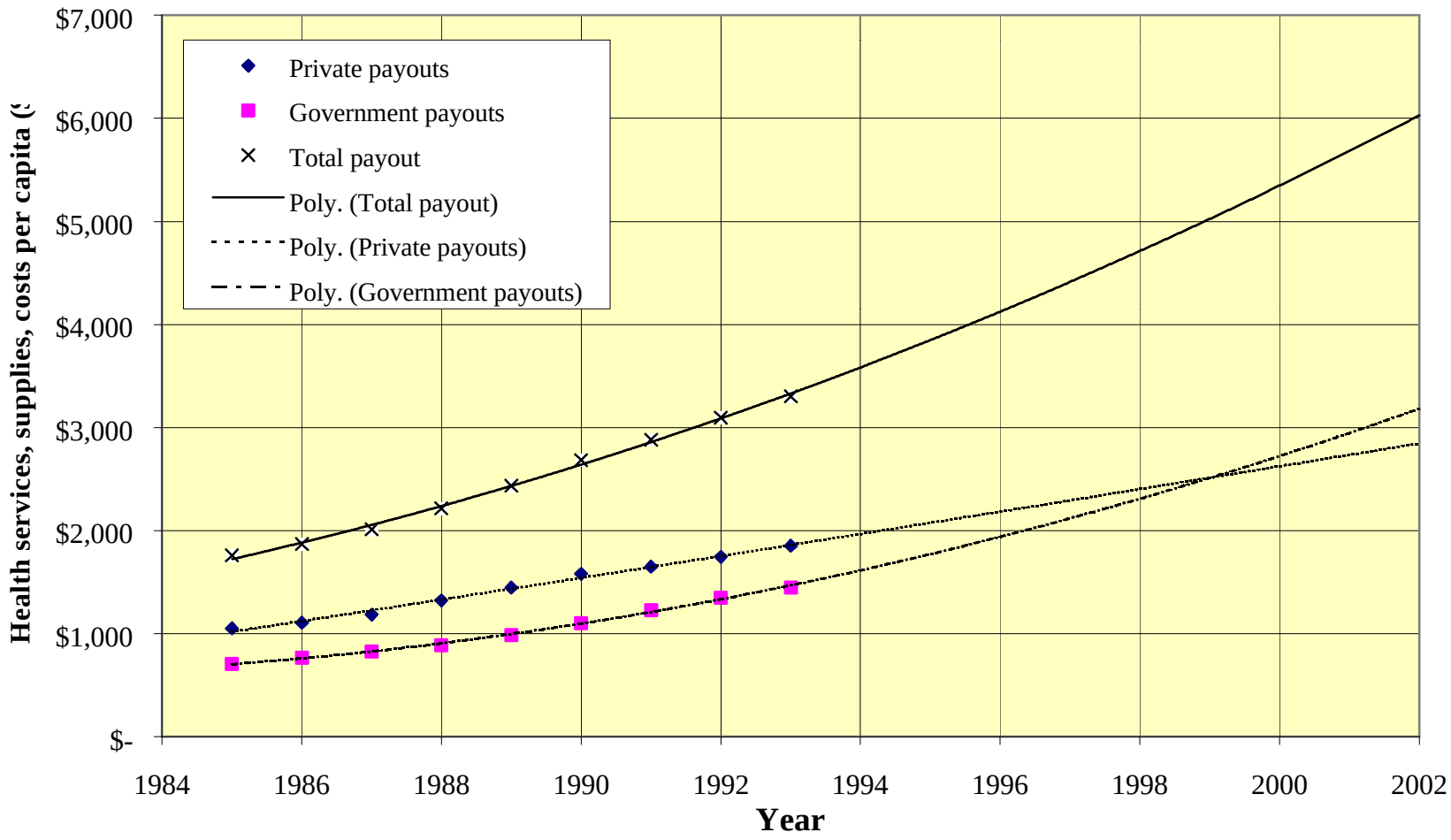
For 1996, consumers will pay approximately $2600 per capita for health care; of this, $850 is direct out-of-pocket expense, and $1750 goes to insurance premiums on average.

Total government spending on health care for 1996 is assumed to be $2250, of which $750 is spent by states, $850 on Medicare, $586 on other federal costs, $4 for the FDA, and $60 on federally supported research and development. An additional $5 is assumed to be provided by private foundations in support of research. These costs amount to more than a trillion dollars in 1996 and approach two trillion by 2002.

In the game, funds have been allocated to approximate these anticipated expenditures. However, many simplifications were required. For example, the Suppliers/Manufacturers are given $800 game dollars in 1998, corresponding to a purchasing power of $400 million. The intent was to allow the team to influence the game, but not dominate the technology system. Other team incomes were similarly adjusted to balance reality and game influence.

Table M-1 shows that private consumers and the government each pay about half of the patient health care costs. However, the extrapolations shown in Figure M-1 predict that the government fraction will exceed the private fraction by the year 2000. For the game, we assumed that these costs were split evenly between public and private payers.

Figure M-1: Health Care Costs: 1985-1993 data extrapolated to 2002



The following table provides some additional information on the fractions of the national health costs that were used in different segments of the medical community.

Percentage allocations of health care resources in the US in 1991:

Hospital care	38.4%
Physicians' services	18.9
Dentists' services	4.9
Other professional services	4.8
Home health care	1.3
Drugs/other medicalnondurables	8.1
Vision products/other medicaldurables	1.6
Nursing home care	8.0
Other health services	1.9
Net cost of insurance and administration	5.8
Government public health activities	3.3
Medical research (separately allocated)	1.7
Medical facilities construction	1.4

APPENDIX N: ADDITIONAL INFORMATION

US Food and Drug Administration:

FDA's Vision

FDA in the year 2000 will be ...

* A strong science-based agency--to accurately detect and assess health risks, and to set appropriate standards.

* A trusted agency--to enforce the Food, Drug, and Cosmetic Act fairly, uphold safety standards, and protect consumers.

* An enabling agency--to steward needed products and to promote public health.

* A collaborative agency--to strengthen ties to scientific, health provider, and regulatory communities both domestically and internationally.

* A high-performance agency--to capitalize on state-of-the-art information and communication technologies and management systems to enhance performance.

* An employee-valued agency--to recruit, develop and advance employees equitably, and to position the agency to meet the changing work force needs of the 21st century.

FDA principally serves the general public in its health and safety mission. FDA also recognizes its responsibilities to the industries that it regulates and will work with them in shepherding new technologies to the marketplace. Thus it strives to maximize public health protection while minimizing regulatory burden.

FDA's Center for Devices and Radiological Health

Medical Devices and Radiological Health

FDA's Center for Devices and Radiological Health is responsible for ensuring the safety and effectiveness of medical devices and eliminating unnecessary human exposure to man-made radiation from medical, occupational and consumer products. There are thousands of types of medical devices, from heart pacemakers to contact lenses. Radiation-emitting products regulated by FDA include microwave ovens, video display terminals, and medical ultrasound and x-ray machines. The center accomplishes its mission by:

- reviewing requests to research or market medical devices
- collecting, analyzing, and acting on information about injuries and other experiences in the use of medical devices and radiation-emitting electronic products
- setting and enforcing good manufacturing practice regulations and performance standards for radiation-emitting electronic products and medical devices
- monitoring compliance and surveillance programs for medical devices and radiation-emitting electronic products
- providing technical and other nonfinancial assistance to small manufacturers of medical devices.

In July 1993, FDA implemented the following policies to streamline and improve the medical device review process:

- "Refuse to File"—a preliminary review of minimum criteria for filing PMA, IDE, and 510(k) submissions
- "Triage"—a method for allocating review resources according to the public health risk associated with a device
- "Expedited Review"—an expansion of existing "fast track" review procedures for live-saving devices to include devices offering other significant clinical benefits.

A PATIENT'S BILL OF RIGHTS

Source: American Hospital Association. © copyright 1972

Often, as a hospital patient, you feel you have little control over your circumstances. You do, however have some important rights. They have been enumerated by the American Hospital Association.

1. The patient has the right to considerate and respectful care.
2. The patient has the right to obtain from his physician complete current information concerning his diagnosis, treatment, and prognosis in terms the patient can be expected to understand. When it is not medically advisable to give such information to the patient, the information should be made available to an appropriate person in his behalf. He has the right to know, by name, the physician responsible for coordinating his care.
3. The patient has the right to receive from his physician information necessary to give informed consent prior to the start of any procedure and/or treatment. Except in emergencies, such information for informed consent should include but not necessarily be limited to the specific procedure and/or treatment, the medically significant risks involved, and the probable duration of incapacitation. Where medically significant alternatives for care or treatment exist, or when the patient requests information concerning medical alternatives, the patient has the right to such information. The patient also has the right to know the name of the person responsible for the procedures and/or treatment.
4. The patient has the right to refuse treatment to the extent permitted by law and to be informed of the medical consequences of his action.
5. The patient has the right to every consideration of his privacy concerning his own medical care program. Case discussion, consultation, examination, and treatment are confidential and should be conducted discreetly. Those not directly involved in his care must have the permission of the patient to be present.
6. The patient has the right to expect that all communications and records pertaining to his care should be treated as confidential.
7. The patient has the right to expect that within its capacity a hospital must make reasonable response to the request of a patient for services. The hospital must provide evaluation, service, and/or referral as indicated by the urgency of the case. When medically permissible a patient may be transferred to another facility only after he has received complete information and explanation concerning the need for and alternatives to such a transfer. The receiving institution must first have accepted the patient for transfer.
8. The patient has the right to obtain information as to any relationship of his hospital to other health care and education institutions insofar as this care is concerned. The patient has the right to obtain information as to the existence of any professional relationships among individuals, by name, who are treating him.
9. The patient has the right to be advised if the hospital proposes to engage in or perform human experimentation affecting his care or treatment. The patient has the right to refuse to participate in such research projects.
10. The patient has the right to expect reasonable continuity of care. He has the right to know in advance what appointment times and physicians are available and where. The patient has the right to expect that the hospital will provide a mechanism whereby he is informed by his physician of the patient's continuing health care requirements following discharge.
11. The patient has the right to examine and receive an explanation of his bill, regardless of the source of payment.
12. The patient has the right to know what hospital rules and regulations apply to his conduct as a patient.

APPENDIX O: GLOSSARY AND ACRONYMS

510(k) One of two ways that new devices enter the market; entry is through a premarket notification process, known as "510(k) because it is authorized under section 510(k) of the Federal Food, Drug , and Cosmetic Act. (See also PMA.) The FDA must determine whether a device is "substantially equivalent" to a device that is already legally marketed.

allogeneic Having a different genetic constitution but belonging to the same species.

arteriosclerosis: Term applied to a number of pathological conditions in which there are thickening, hardening, and loss of elasticity of the walls of arteries; the leading cause of death and serious morbidity in the Western world.

atherosclerosis: The most common form of arteriosclerosis

Biomedical Technology: A field of health care that deals with medical devices, diagnostic products and health care information systems.

Capitation fee: Amount paid a physician annually from each patient in a medical group plan.

cochlea A winding cone-shaped tube forming a portion of the inner ear. It contains the organ of Corti, the receptor for hearing.

CCU Coronary Care Unit

Cytology The science that deals with the formation, structure and function of cells.

D/D Disease/Disability

DoD Department of Defense

FDA US Food and Drug Administration

Health Informatics: The exploitation of information technologies to promote the management and delivery of health care.

hemodialysis Providing the function of the kidneys by circulating blood through tubes made of semipermeable membranes.

HMO Health Maintenance Organization

ICU Intensive Care Unit

IDE Devices can be exported to countries not on the list of advanced industrialized countries if the exporter has an Investigational Device Exemption (IDE) permitting testing on humans in the US, the importing country has given FDA a blanket import approval, and the device is in compliance with the importing country's laws.

IPA Independent Practice Association

ischemia Local and temporary deficiency of blood supply due to the obstruction of the circulation to a part.

LOS Length of Stay

metastasis Movement of bacteria or body cells (esp. cancer cells) from one part of the body to another.

micro- one millionth-

morbidity The number of sick persons or cases of disease in relationship to a specific population.

nano- one billionth-

NSF National Science Foundation

osteoarthritis	A chronic disease involving the joints, especially those bearing weight. This disease is an almost inevitable consequence of aging and is a major cause of severe chronic disability, affecting nearly 10% of the population over 60.
PMA	One of two ways that new devices enter the market; entry is through an extensive premarket approval (PMA) application. (See also 510(k).)
PPO	Preferred Provider Organization
R&D	Research and Development
ROI	Return on Investment
RTW	Return to Work
sputum	Substance expelled by coughing or clearing the throat.
TechnologyRoadmap:	A strategic plan that collaboratively identifies product and process performance targets and obstacles, technology alternatives and milestones, and a common technology path for R&D activities."
triage	The screening and classification of sick, wounded, or injured persons during war or other disasters to determine priority needs for efficient use of medical systems.
VS	vital signs
xenogeneic	Tissues used for transplantation that are obtained from a species different from that of the recipient.